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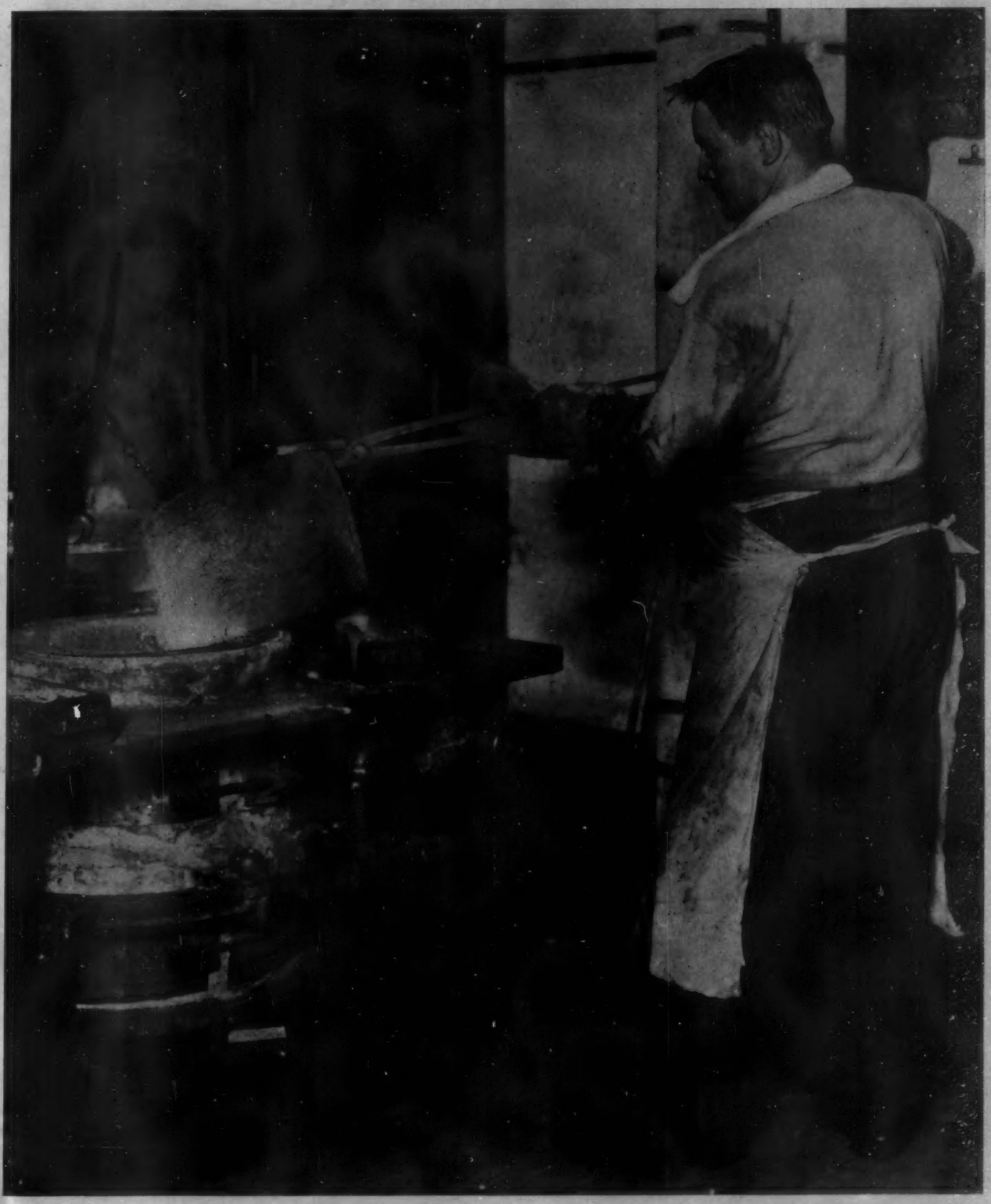

Draining the last precious drops of molten gold from a large crucible into a brick-shaped mold.
HOW GOLD IS BOUGHT.—[See page 417.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Peril of the Short Crossover

THE letter of the vice-president of the New York, New Haven and Hartford Railroad, which we publish on another page, calls to mind the story of the barrister who, on asking his solicitor for the brief, received the answer: "No case; attack the counsel for the plaintiff."

For, it so happens that our article "The Perils of the Short Crossover," which has bitten so deeply into the sensibilities of the New Haven Railroad as to suggest that it must have come very nigh the truth, was not written, as our correspondent suggests, by "a sapient critic, who doubtless derives his knowledge from some relative 'in the railroad business,'" but by that very Editor of the SCIENTIFIC AMERICAN to whom the letter is addressed, who, as it so happens, was formerly, for several years, a member of the engineering staff of one of our railroads, and who wrote the article referred to after consultation with several brother engineers of high standing, and after a careful personal examination of the scene of the wreck.

The New Haven Railroad, through its vice-president, complains that the writer did not follow "the accepted practise of reputable journals in previously submitting a proof" of the article "to the railroad company for criticism and comment."

Here is news indeed! We had always supposed (and still believe) that reputable journals, such, let us say, as *Engineering News* and the *Railway Age Gazette*, maintained their editorial columns on such a high plane of independent, judicial authority, that no corporation, be its power, influence, or patronage what it might, could swing their editorial pronouncements by one hair's breadth in this direction or in that. But if Mr. McHenry is to be believed, it is customary in technical journalism for the judge to submit his decisions to the defendant "for criticism and comment," before they are delivered and disclosed to the general public. If this be so, that public is to be congratulated on the fact that there is at least one technical journal which stands ready to investigate and point the lessons of a fatal disaster on a great railroad with the same independence and impartiality as it would those of the breakdown of an aeroplane or a motorboat.

We have approached this subject of the Westport disaster in a serious spirit and with a sense of the responsibility which the gravity of the accident demands. The letter of this official of the road is sarcastic and is couched in terms of levity which are strangely inconsistent with the serious relation in which the company stand in this matter, both to the public and to that admirable body, the Interstate Commerce Commission. Our articles advanced a theory in regard to the causes of the accident. Does this official of the railroad throw any light upon the subject; does he show any desire to expose the fallacy, if there be any, of the theory we have advanced? Rather, he resorts to ridicule and states that the diagram we published makes the outline of the swaying locomotive resemble a gyrating bronco. We have been serious in our efforts to discover the cause of this appalling accident. It is immaterial whether the diagram we published is suggestive of a bucking bronco or not; but it is very material to discover why the locomotive should have behaved like one. On this vital question the letter we publish maintains a significant silence.

As to the question of the higher speeds permissible on a number 20 crossover, as used on the Pennsylvania Railroad, we must ask our correspondent to believe that our information was derived from an official in the Engineer Department of that road, who outranks those quoted by Mr. McHenry. The speed limit of 35 miles per hour may be on the time cards; but if so, it is more honored in the breach than in the observance, as any person who travels between New York and Philadelphia can see on any day of the year. Disaster on a number 20 might arise from the failure of the rails and fastenings to stand up to their work, or from overturning due to centrifugal force. That the track would not fail is proved by the fact that the heavy engine passed at nearly 60 miles an hour through a number 10 crossover at Westport without leaving the least visible signs of undue stress that the writer could detect. That centrifugal force would not overturn a train at 60 miles an hour or over on a number 20, where the thrust would be only about one fourth as great, may be proved by a simple calculation with pencil and pad.

We are very glad to learn that the New Haven road has been lengthening some of its crossovers. This was urged by the SCIENTIFIC AMERICAN as an absolute necessity after the accident at Bridgeport, some fifteen months ago. The question, however, is not one of the general policy of the road elsewhere on its lines. What the SCIENTIFIC AMERICAN has asked, and still asks, is: Why, in view of the accident of the year before on a number 10 crossover at Bridgeport, did not the New Haven road spend the few hundred dollars necessary to change that crossover to a number 15 or 20, and why did they leave in their tracks, a few miles away at Westport, no less than three similar crossovers, on one of which the recent disaster occurred?

We are greatly interested to learn that in the present case there was a distant signal set at "caution"—that a conductor, a towerman, a section foreman, a home signal set at "danger," and a dwarf signal, failed in their combined efforts to arrest the speed of the train—for it all goes to prove the strength of our contention that the mere laying down of rules of speed will not effectively safeguard a train against inherently perilous crossovers, and that it is the duty of a railroad, therefore, to eliminate from its tracks, as far as it can, all possibilities of disaster due to disobedience of orders or to the physical failure of the engineer of the train. The fact that the railroad exhausted every possible means of appeal to the intelligence of the engineer simply accentuates the argument that risks due to human fallibility should be reduced to a minimum by making the layout of the tracks, as far as is economically possible, "foolproof."

Regarding the latter part of the letter, which does not concern directly the plea in our issue of October 26th, we have this statement to make: The SCIENTIFIC AMERICAN is not in sympathy with legislation, which, in some parts of the country, has been directed against the railroads, simply because they are rich. It is not in sympathy with drastic emotional legislation aimed at the railroads for political effect. We are aware of the fact that the railroads have fared badly at the hands of certain demagogues, and that in some cases they have not obtained just treatment. The SCIENTIFIC AMERICAN admired, beyond measure, the courage of the Governor of New Jersey, now the President-elect of the United States, when he vetoed a bill during the past year, which he considered imposed an unreasonable and unjust burden upon the railroads passing through that State. The SCIENTIFIC AMERICAN stands for justice and fair play on the part of the political parties toward the railroads; but at the same time it demands that the railroads shall secure to the public the highest possible safety of travel. When a railroad fails in this respect, it shall be the self-imposed task of this paper to try, honestly and impartially, to ascertain the reasons; to point out the lessons of such accidents as that at Westport, and to suggest the proper remedies. The bucking of that bronco of a locomotive—to use the felicitious phraseology of our correspondent—on a number 10 crossover was no wanton act. When it left the tracks it did so in obedience to the inexorable laws of centrifugal force. It is for the proper authorities to determine how and why it became possible for those laws to be so disastrously defied, and to enforce such changes in track construction that any repetition of the Bridgeport and Westport disasters may be rendered *physically* impossible.

In conclusion and in proof of our impartial attitude in this discussion, we wish to state our conviction that the four-track system of the New Haven Railroad between Woodlawn and Bridgeport is one of the finest stretches of road in the world. With its 100-pound rail, its tie-plates on every tie associated with *screw* bolts in place of the archaic spike, and its deep bed of broken-stone ballast, it presents an example of absolutely first-class construction that is a delight to the eye of the engineer. By the very measure of that excellence does the presence of these abominable short crossovers, with their eternal menace to the safety of the fast traffic, appeal to the engineer as a blot upon an otherwise exceedingly fine example of high-class American railroad construction?

Unscientific Futilities

TRUE science is perforce both sane and utilitarian; and her votaries have ever definite objects in view, which they seek by reasonable and practical means. There have been instances of doings assumed to be scientific that would hardly fill these specifications, but which have a jocund interest and may besides possibly have instructive point.

An illustrious nature lover (and not a nature fakir by any means) becoming interested in the question "Why does a mosquito refuse to touch a frog?" and perhaps with an ultimate view to the elimination of both these pests, rightly concluded no fair answer could be given the question until it was determined if the mosquito does really make this blessed exception. So the experimenter repaired after nightfall to a marsh, where he held up a frog in the presence of the mosquito host. His hand was most grievously bitten, while the frog had never the slightest occasion to scratch himself. One is here reminded of the Hibernian gentleman who held his dog all night in the snow to freeze it. It seems never to have occurred to our nature lover to have saved himself those dreadful stings by wearing a glove stout enough to be impermeable even to mosquitoes. Nor for all his pains did he prove anything worth while. For whether mosquitoes sting frogs or no, the two genera have from time immemorial been known to flourish in the same sort of place. There seems to be an amicable relationship, a sort of business understanding between them, the mutual object being the vexation of humankind. True, frogs are supposed to eat mosquitoes; but this seems to be done genially and without heat, after the fashion of the companionable walrus in "Alice in Wonderland," who after dancing with the oysters, tearfully devoured them. And yet the alleged proclivity on the part of frogs, to eat mosquitoes, seems not to have diminished the visible and working supply of the latter. Their joint presence in marshes has been so detrimental to nocturnal comfort and to the value of nearby real estate that something ought certainly be done—something rational, however. These creatures are both musically inclined and presumably they enjoy each other's songs—a penchant not generally shared by their human neighbors; and yet after some persons we have heard sing, we should rather, if we had to make a choice, decide not unfavorably to the marsh denizens. Be all this as it may, the only rational purpose of any experimentation in the premises would be the elimination of the mosquito and the frog; and there is no other way to achieve this than to drain the marshes.

Another "scientific gent," a resident of the cactus belt, was some time ago (possibly still is) zealous for the formation of a cult of cactus eaters. The spineless cactus of lower California has been his favorite food; he has been eating it, drinking concoctions of it, taking it in soup and omelette and salad; and he gained weight in the fortnight when he lived exclusively on cactus. Nevertheless he has, no doubt, long before this, found the habit an absurdly expensive one; and any cactus-eating cult, unless it be made up of millionaires, must inevitably die out for the monetary reason alone.

It was some time ago reported that a fellow-citizen has made a will consigning his body, after his death, to various mechanical uses. Buttons are to be made of his bones; leather bags of his skin; fiddlestrings of some of his more intimate internal relations. This gentleman proclaimed himself a utilitarian, determined to practice his creed to the very death. Yet his philosophy is really not utilitarian. For the bone button market is now so well supplied, these articles sometimes get into places where they certainly have no business—into soup, for a horrible example. And there is no dearth of fiddlestrings—more's the pity. And what normal individual would care to buy and have about him bags made of human skin—and this in an era when felines and canines, whose pelts would make much better bags, are so prolific and can be had so reasonably as to expense. In point of fact, it would cost more to transfer the mortal remains of this pseudo-utilitarian into merchandise than the product would bring in the open market.

The Hardened Copper of the Ancients

IT is commonly supposed that the ancients succeeded in hardening copper. Metallurgists who have examined specimens of this so-called hardened copper have found that it is not pure copper, but usually an alloy of copper, either natural (that is, the two metals existed in one ore, so that in the process of reduction an alloy was formed) or an artificial alloy made by melting two ores together, the one copper and the other zinc. The so-called Monel metal, now a regular product of an eastern copper refinery, is the modern equivalent of the ancient natural alloy—a compound of copper and nickel obtained by reducing the copper-nickel ores of the Sudbury mines in Ontario. All the arrowheads and other implements which have been found in the Sudbury district are made of this native copper-nickel hardened only by hammering.

Electricity

Delay in Traffic on an Electrified Railway.—The total delay by troubles in electrical apparatus last year on the thirty-three electric locomotives operating in the New York terminal district of the Pennsylvania Railroad amounted to only 13 minutes. The total mileage run of these locomotives was 900,000, including a mileage of 56,000 for a single one of the locomotives.

Telephony at a High Altitude.—The highest telephone station in the world, according to a German paper, is that in the meteorological observatory on the top of Mont Rosa in the Pennine Alps, 15,450 feet above sea level. At this elevation snow is always found, and advantage is taken of the high insulation given by dry snow, the wires in the last section, at the peak, being simply laid on the snow-covered ground. To prevent breakage by glacier movements the line is carried through rings on the telephone poles. The poles are very short and are taken down at the end of every summer season and replaced at the beginning of the following summer.

Electric Power for the St. Gothard Tunnel.—According to Dr. Kummer's calculations for the amount of power which is needed to operate the St. Gothard line and tunnel on the electric system, the total cost for the power-plant work will be $14,000,000, and the current is obtained from the Göschenen, Amslig and Ritom hydraulic plants. It is proposed to operate separately the sections lying north and south of the tunnel. About 30,000 horse-power is needed on the north side and 37,000 on the south. The above hydraulic plants could be called upon for 95,000 horse-power. The electric line will be best operated on the 15,000-volt alternating current system.

Running a Railroad with Wireless Time Signals.—At the St. Quentin station on the Northern Railroad in France there has been installed a wireless telegraph station for receiving time signals from the Eiffel Tower station so as to have the exact time and thus be able to set the station clocks more accurately than before. The distance from Paris is about 95 miles, so that the time signals are well received even with the small aerial used. No doubt the railroad will extend the use of the wireless method in the future. A station which is so equipped can also send the time over the ordinary telegraph lines to other railroad stations.

Electric Heat for Shrinking on Wheel Rims.—Although the cost of electricity for heating is generally higher than the cost of fuel to accomplish the object by ordinary methods, electric heating for special mechanical purposes often shows a distinct operating economy due to the saving of time attained by its use. An instance is an electric heater for shrinking on wheel rims, consisting of a built-up iron ring with grooves containing a heating coil traversed by an alternating current and adapted to be laid in contact with the rim that is to be shrunk on. The heating is rapid, and it is found that the expansion of the rim continues after the current is switched off in the heater, allowing time for the wheel body to be got ready for insertion in the rim. As compared with a gas fire, two or three times as many rims can be shrunk on in a given time by this appliance.

Conservation of Heat Energy in the Coal Pile.—Electrical engineering is constantly at work seeking to transform the largest possible percentage of the total available heat energy in coal into electrical energy, and to this end has endeavored to improve the efficiency of steam engines, steam turbines and internal combustion engines. Another way to conserve the heat energy of the coal used under the steam boiler is to protect this fuel from deterioration of the value that it has when purchased, that is, from the loss of heat units, during long storage, by exposure to the air and also by spontaneous firing of coals containing sulphur. An Indianapolis electric light company has devised an under-water coal storage pit containing 25,000 tons, of which 15,000 tons can be submerged. This pit, which represents an investment of $20,000, will be filled by gravity, thereby limiting the cost of handling the coal to one transfer.

Electricity on Italian Railroads.—Some important changes are being made on the Milan-Gallarate-Portoceresio electric railroad in the north of Italy. This line was one of the first to be installed in the country, and it is now on the point of adopting modern methods. The old steam plant of Tornavento, which was expensive to work and is now too small, will be shut down, and the current for the road will come from the large hydraulic plant of Varzo on the south side of the Simplon. Current at 45,000 volts is brought to Gallarate by a power line running along the railroad, and the current for the cars is supplied by seven substations spaced along the line, instead of the four stations which were formerly used. Owing to the increased amount of power which the railroad now has at its disposal, it is able to run heavier passenger trains than before and also does away with the use of steam locomotives on the freight trains. For the heavy passenger traffic there are used five large electric locomotives of 2,000 horse-power. At the hours of light traffic the trains will be made up of a few motor cars according to the usual method.

Science

New Heat-resisting Glass.—While the new variety of glass known as quartz or acid glass is valuable from the fact that it resists heat and does not crack when suddenly heated and cooled, so that various apparatus can be made of it, such glass has a tendency to crystallize when heated for a long time near the melting point. This makes the glass mechanically weaker and it changes more with heat. A new glass made by M. Thomas does not become de-vitrified in this way, and he obtains it by using silica to which is added a small amount of certain metallic oxides, these being acid oxides, especially zirconium or titanium oxides. As small an amount as 0.1 per cent is enough to increase the mechanical resistance by 20 to 50 per cent, and the general properties are much superior. He considers that the glass contains a colloid solution of the oxides, so as to hinder crystallization.

Corrosion of Aluminium Kitchen Utensils.—Sheet aluminium is now frequently used for making kitchen utensils and the like, but these are noticed to become corroded without actual usage, as for instance when kept in stores. Tests made in Germany on the subject are intended to show the condition of the rusting or rather efflorescence on the metal, this being produced by oxidation. When the coat is removed, the metal is seen to be more or less deeply scored. Analysis shows that the coating contains aluminium, lime, silica and magnesia. Sheet aluminium was exposed to the action of distilled water or ordinary water, and this gave a more or less rapid attack. This was less rapid when the plates were placed in air and water in turn, but surface oxidation also occurred. It appears that the water must contain oxygen in order to attack the metal. The effect increases with the heat and also in the presence of carbonic acid.

Traveling and Exploring in Siberia by foreign men of science, although not prohibited by the Russian government, entails a good deal of preliminary red tape, according to information on this subject furnished by the American consul at Vladivostok. Permission should be requested through the embassy at St. Petersburg several months in advance. The number and kind of guns that one desires to bring must be specified, as the importation of firearms into Russia without special permit is contrary to law. Visits of foreigners to coastal Siberia are not looked upon with favor by the authorities. The sportsman is reminded that the hunting of sable has been prohibited throughout Siberia and the Russian Far East for three years beginning February 14th, 1913. The best plan is to make trips under the auspices of some well-known scientific body, rather than on one's own responsibility.

Changes on Jupiter.—During the greater part of the 1912 apparition of Jupiter the northern equatorial belt of the planet has been abnormally faint as though partially obscured by a film of vapor. On August 23rd a dark spot was observed in the region of this belt, approximately in longitude 215 degrees. The disturbance seemed to increase rapidly, apparently spreading in the direction of the rotation of Jupiter, and its mean rate of motion has been greater than required for system I, though the disturbance seems to be chiefly in the latitudes of system II. Its progress was such that by October 7th the disturbance extended more than 287 degrees around the disk of the planet. A few days prior to October 5th the preceding part of the area had made a complete circuit around Jupiter and from recent observations the whole northern equatorial belt has apparently been cleared of the white matter which obscured it. This belt is at present a conspicuous feature of the planet. The appearance of intensely dark condensations and the rapid proper motion of the disturbance have indicated that the manner in which the belt reformed was somewhat spectacular.

Surveying the Congo Region.—The use of modern methods for laying out frontier lines in the colonies is well brought out in the work which is being done in the Congo region. According to a recent treaty, France ceded a certain amount of territory in Africa to Germany in exchange for concessions in Morocco, so that this led to expeditions on the part of both countries in order to fix the boundary lines. Capt. Periquet states that wireless telegraphy will be used for the first time on a large scale so as to determine latitudes exactly. Wireless stations now exist in the French possessions, also in Cameroon and Belgian Congo, and all these are to be utilized by the expeditions. They will carry improved kites for mounting the antenna wires, also the necessary wireless posts. For taking the latitude they use prism astrolabes which give very close results. These measurements will be combined with plans drawn up on the spot by the alidade, this latter being used especially for the important points. Once in possession of the data, they will draw up a map of the frontier region on as large a scale as possible. Other scientific work will be done at the same time, which is likely to be valuable, such as hydrography, orography, questions of population, botanical and ethnological research, terrestrial magnetism and the like

Aeronautics

An Aerostructural Balance.—For automatically balancing an aerostructure, Roy M. Palmer of Washington, D. C., in a patent, No. 1,039,181, presents in connection with ailerons a shifting fluid column and an electrically operated means connected to the ailerons and having a series of superimposed electro-magnets, the shifting of the fluid column operating to energize the electrically operated means to shift the ailerons to various inclinations. An arrangement is also provided to maintain the ailerons at the proper point when the fluid column returns to normal position.

Paris Aero Show.—The fourth aeronautic show to be held in Paris was opened on the 26th ult. by President Fallières, assisted by the Ministers of War and of the Marine. Sixty of the latest aeroplanes are on exhibition, while but two balloons and no airships are to be seen. The show is given up almost entirely to military aeroplanes and hydro-aeroplanes for the use of the navy. The chief of the latter is the Astra biplane which won the St. Malo meeting. This machine is made entirely of metal and the float at the rear end of the fuselage forms a rudder so that the hydro-aeroplane can be steered when running on the water. The exhibition of aeronautic motors is a large one, the most noteworthy of these being the 400 horse-power motor of the Astra-Torres dirigible for Great Britain. The War Department, besides showing aeroplanes and their component parts, has on exhibition the automobiles used for transporting such machines and repairing them. Sailors have charge of the Government hydro-aeroplane exhibit. The SCIENTIFIC AMERICAN hopes to publish soon an article, illustrated by photographs, of the principal exhibits at the Show, an article that will critically point out what is good and what is bad.

Fatal Balloon Accident in Germany.—While trying out his new balloon preliminary to the Gordon Bennett race, on October 20th, Lieut. Hans Gericke, the well-known German aeronaut and the winner of the Bennett race last year, fell to his death with his aide as a result of his balloon bursting when at a height of about 3 miles. Lieut. Gericke, soon after he started out and while at an elevation of about 6,000 feet, approached a thunder shower and was caught by a sudden upward current which carried the balloon to a height of 15,000 feet in a very short period of time. Either on account of the rapid expansion of the gas, or because it was struck by lightning, the balloon burst and the two men fell to their deaths at a terrific speed. This accident proves that no matter how experienced the pilot or how well-built the balloon, there is an element of danger in ballooning that is not met with by the heavier-than-air machines. It would seem that ballonists should be equipped with a safety parachute, such as has recently been invented by A. Leo Stevens, so that in case of such an accident, they could jump out of the basket and descend safely to earth.

New Records with Model Aeroplanes in America.—As mentioned in a recent issue of the SCIENTIFIC AMERICAN, a number of new model aeroplane records were made at the Aeronautical Society's exhibition on Staten Island, on October 12th. The chief of these was a duration record for monoplanes launched from the hand of 158 4/5 seconds made by Armour Selley of the New York Model Aeroplane Club. Young Selley's model soared 40 feet high and traversed a distance of over 2,000 feet before alighting. The best previous record, made in England, was only 1,431 feet, though Selley's model flew 2,653 feet at Mineola last summer. The American duration record for a flight from the hand—91 2/5 seconds—was broken four times on Columbus Day, it being raised respectively to 92 1/5 and 96 2/5 seconds, 119 2/5 seconds and 158 4/5 seconds. The record-holder is young Selley, who, with a model 40 inches long, fitted with but fourteen strands of 1/8-inch wide, flat rubber bands, made a remarkable flight of 2 minutes, 38 4/5 seconds duration, thus breaking by 55 4/5 seconds the world's official duration record. In the competition for monoplanes over 4 feet long, starting from the ground, George A. Page, Jr., of Hillsdale, N. J., made a new world's record of 585 feet. In a similar competition for models under 4 feet in length, H. Schultz won the first prize by a flight of 726 feet. At a second meet, held on Election Day, Selley's model, resting on skids and starting from the ground, flew 1,408 feet, while George A. Kavanah's flew 1,400 feet. The best record of this kind—1,184 feet—was made by Dr. Dedderer some time ago. Selley's record-breaking model, and in fact most of the models used this year, are monoplanes with a small guiding surface far out in front on a triangular (in plan) fuselage, the distinctive feature of the American models being that they all use propellers at the rear instead of tractor screws. A tremendous advance has been made by American boys during the past year in the construction of model aeroplanes, and it is wonderful indeed to find that a good sized model can be propelled half a mile through the air by means of a few elastic bands.

Launching Ships by Trigger

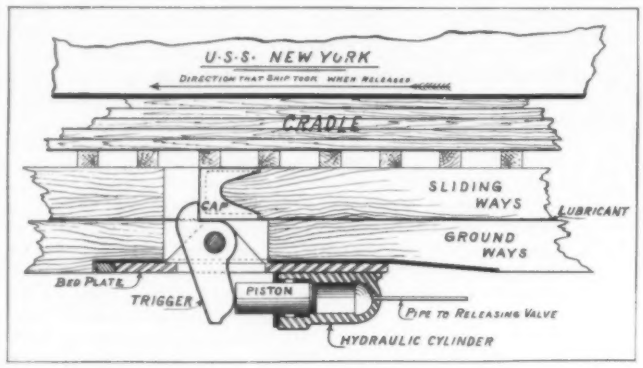
IN the launch of the battleship "New York" recently at the New York Navy Yard, Brooklyn, a departure was made, for the first time at this yard, from the time-honored method of releasing a ship by sawing through the timbers which prevent its movement down the ways.

The work of launching the ship with all the careful preliminary preparations was done under the immediate supervision of the chief naval constructor of the yard, Robert Stocker, who was responsible also for the building of the "New York," the immediate oversight of which was delegated, as we stated in our article at the time of the launch, to Naval Constructor John E. Bailey.

The "ways," which play such an important part in the launching of a ship, are of two kinds: the ground ways and the sliding ways. The former are permanent and immovable; the latter are temporary and move with the ship into the water. The ground ways consist of two lines of heavy longitudinal timbers, one on each side of the keel of the ship, placed about midway between the keel and the turn of the bilge. They are laid upon lines of piling, which are driven down to a firm bearing, with a carrying capacity sufficient to hold up the ground ways firmly in place, and insure them against any settlement under the great load of the ship. Laid immediately upon the ground ways are two similar lines of longitudinal timbers which constitute the sliding ways. Between the faces of the two ways is placed, for purposes of lubrication, a heavy coating of grease.

The launching weight of the "New York" was 10,000 tons, and the inclination of the ways resulted in a heavy thrust which had to be resisted until the moment arrived for letting go the ship. Under the old method of launching, the sliding ways were locked to the ground ways by two heavy balks of timber. In launching, cross-cut saws were used to cut through these timbers and so release the ship.

Under the new method, as shown in our illustration, a massive steel trigger is pivoted in the ground ways, and in its normal position engages a cap set in the sliding ways. It is maintained in place by a hydraulic piston. When the signal is given to release the ship, a releasing valve is turned, and the glycerin in the hydraulic cylinder is allowed to escape. The pressure in the cylinder being removed, the trigger swings on its pivot, disengaging the cap, and allowing the ship with its cradle and sliding ways to move down into the water.



The hydraulic trigger used in launching the battleship "New York."

A Forty-mile-an-hour Dreadnought

By F. C. Coleman

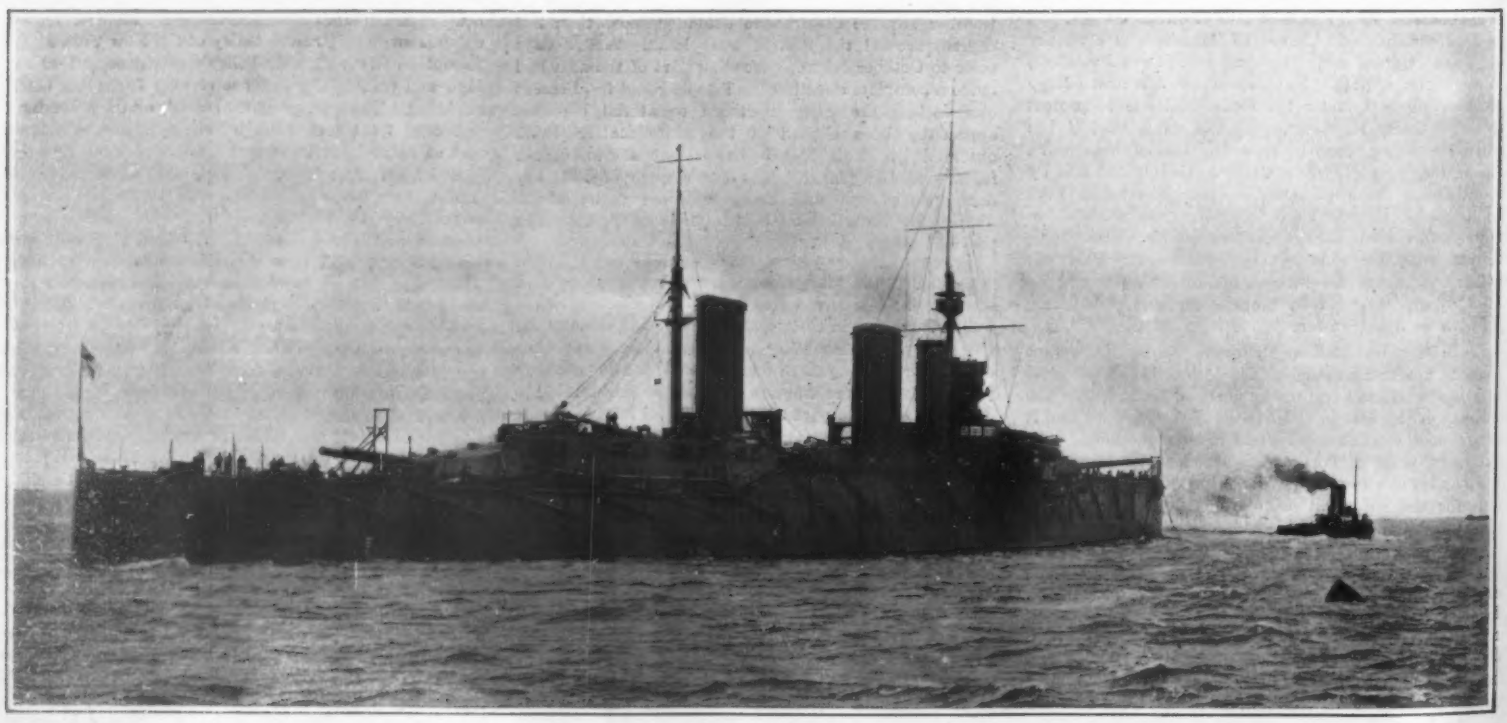
THE British battle-cruiser "Princess Royal," constructed and completely equipped for service at the Naval Construction Works, Barrow-in-Furness, England, in covering a measured mile during her trials at 34.7 knots has established a world's record for vessels of her class. She is 660 feet long between perpendiculars, 88 feet 6 inches beam, and, with a draft of 28 feet, has a displacement of 26,350 tons. Like H. M. S. "Lion," she is the largest cruiser yet built for the British Navy, and is also the broadest, excelling even the "Lusitania" and "Mauretania." The eight 13.5-inch guns in the "Princess Royal," as in the "Lion," are much more effectively disposed than in the earlier armored cruisers. Forward there are in the center line two twin-gun turrets, the one to the rear being at a higher elevation, so that its guns fire over the turret in front. Amidships in the center line there is one twin-gun turret, and aft there is another. Thus all eight guns fire on either broadside. Four fire directly ahead, but by giving a slight angle of helm the ship may alter her course sufficiently to enable all eight guns to be utilized in chasing the enemy. In the "Conqueror," which belongs to the "Orion" class, there are ten 13.5-inch guns, arranged two pairs forward and two pairs aft, the rear pair in each case being at a higher level than those immediately in front. The remaining turret is in the center line amidships. There are in both the "Princess Royal" and the "Conqueror," sixteen 4-inch breech-loading guns for repelling torpedo-boat attack; these are located on the superstructure deck. In the matter of armor protection something had necessarily to be forfeited in the case of the "Princess Royal," in order to insure the exceptionally high speed required by the tactician. This is, perhaps, the only point, with the exception of the omission of two of the primary guns, which differentiates the two types—the battleship and the armored cruiser. As in all warships, there are three tiers or strakes of armor-plating. While the thickness of the water-line strake in a battleship is 12 inches, the remainder of the upper deck being 9 inches or 8 inches, the "Lion" has, for the water-line and for the strakes above it, 9 inches of armor. The gun positions are also well protected. Forward and aft the thickness of the broadside armor is reduced by gradual stages to 4 inches. It will thus be seen that the "Princess Royal," notwithstanding her exceptionally high speed, has armor which is superior in its resistance to perforation by modern guns to that of pre-dreadnoughts; in fact, with their legend speed of 28 knots, as compared with the 17 and 18 knots of the earlier ships, the "Lion and the "Princess Royal," as well as the "Queen Mary," now being built by Messrs. Palmers at Jarrow-on-Tyne, could steam round a fleet of pre-dreadnoughts and fire when it suited them, keeping beyond the range which would enable the old battleship guns to penetrate the armor of the modern cruiser. It is often said, of course, that personnel must necessarily be considered, but it is reasonable to assume that the efficiency would be of as high a standard in the new ships as in the old, especially as in the former there is superior gun-control and sighting mechanism, which will insure greater accuracy in service. The principal steam trials included a 24 hours' run at two thirds the total power, and an 8 hours' run at full power. Both tests were, of course, carried out at the service draft and under limiting conditions as to air pressure in the stokehold. The coal consumption on the 24 hours' trial was 1.16 pound per shaft horse-power per hour for all purposes. The power of the 8 hours' run exceeded that required by the contract, and the speed was also considerably in excess of the designed rate, notwithstanding that no attempt was made on the official trial to test the maximum steaming capacity of the boilers.

The "Princess Royal" and the "Lion," being alike both in respect to the form of hull and the propelling machinery, the British Admiralty ordered at the outset two sets of propellers for the "Lion" and two sets for the "Princess Royal." The "Lion" carried out duplicate tests with the respective propellers, and the second set was fitted to the "Princess Royal," and she carried out the measured-mile trials, corresponding exactly to those run by the "Lion" with the different sets of propellers. The results of all four sets of trials will enable the Admiralty to determine the most suitable dimensions of screw propellers for this type of ship, and these will be utilized in both vessels.

Upon her full power trials, off Plymouth, the "Princess Royal" attained the high speed for a vessel of her class of 32 knots. But that was not the best she could do. On her return, she was dry-docked at Devonport and her propellers were changed. She coaled and went out again for six runs at three fourths and then at full power on the Polperro measured mile. On the last-mentioned occasion, it is authoritatively stated that she reached a speed of no less than 34.7 knots and made an average of 33 knots, which establishes a world's record for vessels of her class. It may be recalled that the original maximum speed of the "Lion" was 29 knots, but that she subsequently made 31.7 knots.

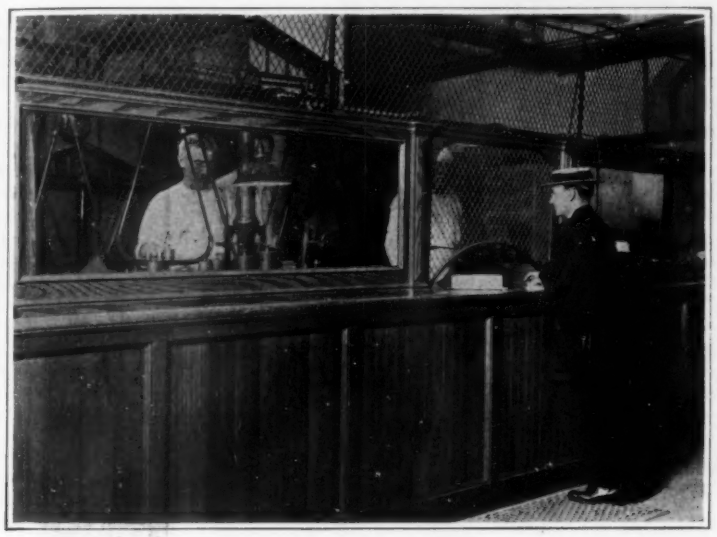
International Show at St. Petersburg

THE Imperial Russian Automobile Club is organizing its fourth international automobile show, to be held at St. Petersburg next spring. The show is to last fifteen days. The opening date is not as yet fixed, but will probably be between April 17th and May 7th.



The 34.7-knot battle-cruiser "Princess Royal."

Length, 660 feet. **Beam,** 88 feet 6 inches. **Displacement,** 26,350 tons. **Speed:** Average of six runs on measured mile, 33 knots; maximum run, 34.7 knots. **Armament:** Eight 13.5-inch guns. **Armor:** Belt, 9 inches; gun positions, 9 inches.



Receiving a deposit of gold.

Weighing gold on assay balances.

How Gold is Bought

The Methods of the United States Assay Office

By Jesse Simmons

SUPPOSE that you owned a gold mine. What would you do with the gold? In the ordinary commercial lines the marketing of the product depends upon ability to place it before the people, and involves the meeting of competition, adjustment of freight rates and the surmounting of numerous little difficulties, all of which have a bearing upon the ultimate result of your undertaking. With gold it is different. Uncle Sam stands ready to buy all of the gold brought to his mints or assay offices.

There are three coinage mints where you would be able to dispose of your bullion, viz., Philadelphia, Denver, and San Francisco. Should it happen that your mine was not located convenient to any of these mints, you would find United States assay offices at Boise, Idaho; Carson, Nevada; Charlotte, North Carolina; Deadwood, South Dakota; Helena, Montana; New Orleans, Louisiana; New York city; Salt Lake, Utah; and Seattle, Washington. At these institutions gold bullion is purchased and forwarded to the mints.

You would take your gold into the office and watch it weighed upon a pair of balances so sensitive that although they had several hundred pounds in each pan, one one-hundredth of an ounce would be indicated. Having weighed your gold, the officials would issue you a receipt for it which you would keep until you received your check or coin in payment. Your gold would then have become what is known in the office as a "deposit." This deposit, with many others like it, would be turned over to the melting department, where, in a specially constructed furnace, it would be melted in a plumbago crucible with the proper fluxes and poured into a suitable mold. Simple as this may sound, the melting of gold is a very serious and difficult task. The high heat which it is necessary to generate in order to melt the metal necessitates a furnace constructed of the most refractory material. These furnaces are usually operated by gas or oil and are built of the very finest grade of fire brick and fire clay. The plumbago crucible which is used is composed of graphite (the same material that comprises the center of your lead pencil), a little fire clay and a little sand. In the manufacture of these crucibles great care must be taken to secure a uniform mixture of the component parts, so that when heated no portion of the vessel will expand more than any other portion. Unequal expansion would cause cracking.

The crucibles are fashioned in molds and dried, or burned in kilns, after a fashion similar to dishes or bricks. They are made in all sizes from those having the capacity of an after-dinner coffee cup to immense sizes holding over twelve gallons. Before melting gold in one of these crucibles it is necessary that it be very carefully annealed, which means that the last possible traces of moisture must be expelled by slowly increasing the temperature for several days. This is done by placing the crucibles in a steam-heated oven, where the process is carried forward until it is deemed that the vessel is in suitable shape to be placed in the fire. Covers and stirrers are made of the same material as the crucible. The latter are used to stir the gold in the crucible after it is melted. Covers and stirrers pass through the same annealing process as the crucibles, although it is not necessary to take so much care with them.

Gold coming direct from a mine is never pure. It may contain various base metals, the nature of which depends upon the process by which the gold was won from its matrix. Gold from stamp mills contains some iron, very likely some copper and often some quicksilver. From cyanide mills the bullion nearly always contains zinc, as this metal is made use of in the process. The zinc, too, may also have contained impurities, some of which will very likely be in the resulting bullion. Copper has some of the characteristics of gold, both physical and chemical, so that if copper is contained in the original ore some of it will be very likely contained in the bullion. Silver is always associated with gold in the ores of the latter. The amounts may vary greatly, but it may be stated that silver is always present in gold ores.

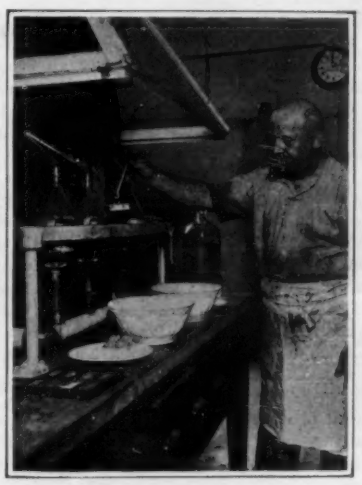
The problem of the melter who handles the deposits at the assay office is to make from the deposit a bar of bullion which will be homogeneous, or in other words, a perfect mixture from top to bottom and from end to end of the gold and other metals. In order to do this he places in the crucible with the deposit a stated amount of flux, varying with the size and composition of the deposit. The virtue of this flux is to remove a certain portion of the base metals and likewise to form a molten mass over the top of the bullion which will prevent volatilization of the precious metals. It is lighter in specific gravity that the metal and rises to the surface of the melt. For clean bullion the flux is composed usually of borax. Perhaps some little soda will be added. For bars which contain five or ten per cent or more of the base metals the flux will be comprised more largely of soda. This is just the ordinary soda which the housewife uses in collaboration with sour milk to make biscuits or other dainties. Niter is also used on bars containing large amounts of impurities.

Having placed the deposit in its crucible in the furnace, with the necessary fluxes, the heat is applied and the metal and flux melted in thirty to forty-five minutes. The melter puts on an immense pair of asbestos mitts to protect his hands from the intense heat and removes the cover of the furnace, the cover of the crucible, and taking the stirrer in a pair of iron tongs, he carefully stirs the entire content of the crucible. The stirrer was placed in the furnace at the time the crucible and charge were admitted, and is of the same temperature as the

Weighing the bars of bullion.

Boring a bar for samples.

Removing assays from cupel furnace.



Removing gold assays from boiling apparatus.

HOW GOLD IS BOUGHT

other contents. On very dirty or impure bars this stirring may be done two or three times, the furnace being closed in order that the heat be brought up to the required point after each stirring. The molds into which the gold is poured are made of iron and a full stock of the various sizes is kept on hand so that no matter what the size of the deposit a bar will be turned out with a width approximately twice its depth and a length about twice the width. Into this receptacle the melter pours the contents of the crucible. The metal sinks to the bottom, and the slag, as the flux is known after it has passed through the process, rises to the top. After the metal and slag have solidified the mold is overturned, the slag separated from the bar, the bar cleaned and weighed. In order that the depositor may receive pay for every bit of gold which properly belongs to him, the inside of the crucible is scraped clean and the slag treated by being crushed to powder and panned in a miner's gold pan. The problem of the melter, then, it will be seen, is to add the proper flux, to see that the furnace produces the high heat which is necessary in order to successfully melt the charge, to have his crucibles in such shape that they will not break in the furnace when subjected to the high heat and to dexterously pour the bullion into the mold and recover the values from the slag.

The weight of the granules which have been recovered from the slag is added to the weight of the bar and this amount is the weight of bullion for which the depositor is paid. It is then the assayer's business to determine the proportions of gold, silver and base metal in the bar. These proportions are reported in thousandths. He obtains a sample by means of a special clipping machine designed for the purpose.

A complicated chemical process is necessary to determine the fineness of this sample. It cannot be described in detail here. Suffice it to say that the process is based upon the fact that from an alloy of gold and silver in which silver predominates in the ratio of about three to one it is possible to dissolve the silver by nitric acid, leaving the pure gold behind. To a weighed portion of the bullion is added an amount of silver which will bring the proportion up to three to one, if it is rich in gold, or, if it is rich in silver, sufficient gold to bring it up to this same proportion. This sample weighs one thousand gold-weight, or one half gramme; very nearly seven and seven tenths grains. It is rolled up within a piece of pure lead foil weighing about two grammes. An exact duplicate of this is made, as are also two similar samples from the opposite side of the bar. Two other samples are prepared of a weighed amount of absolutely pure, or "proof" gold, and silver, called the proof samples. A fourth set of samples is made from one thousand gold-weight of the bullion, which is likewise incased in lead.

These samples are then placed in cupels, in a furnace which has been heated to a bright red. A cupel is a small dish, a little more than an inch in diameter, made of boneash, and boneash is pulverized calcined animal bones. A cupel has the property of absorbing oxides of lead and other base metals when these oxides are formed during cupellation. What occurs in the furnace is practically this: The lead and other metals melt, and as the air passes over this molten mass the lead and base metals oxidize rather rapidly. A portion of these oxides are absorbed by the cupel and other portions pass off in the form of vapor. The final result of the process is a globule of gold and silver. The first three sets of samples (the top, bottom and proofs) which contain the proper proportion of gold and silver for parting, as the nitric acid treatment is known, are rolled out thin and placed in small cups of platinum. These cups fit neatly into a basket of the same material and the whole is then suspended in a platinum cup containing boiling nitric acid which dissolves the silver, leaving pure gold in the cup. This is very carefully dried at a low heat, placed in the furnace to be momentarily heated to a cherry red, removing the last possible trace of moisture and weighed on the scales upon which the samples were originally prepared. This weight shows the amount of gold in the bullion, after making the necessary corrections indicated by the proof samples' gain or loss during the process. The fourth set of samples, which after cupellation are globules composed of gold and silver, the base metal having been driven off during the cupellation, are weighed without any further preliminaries. Their loss in weight indicates the amount of base metal which was in the bullion. Having determined gold and base metal, the difference is reckoned as silver.

The scales used by the assayer in his work are the most delicate of the appliances used in the assay office, although the large balances upon which the deposits are weighed are themselves of extreme accuracy. But the assayer's scales take the palm. They are sensitive to one two hundredths milligramme. Fearing that it will not be realized what this means it will be explained further. These scales will weigh a lead pencil mark. Some time when you are in the assay office depositing the hypothetical gold from the hypothetical mine, ask the assayer to weigh a piece of paper an inch square. After he has done this make a mark across this paper with a soft lead pencil and you will be surprised to see that it is possible to weigh this mark. It will weigh anywhere from one to three one hundredths of a milligramme, depending upon the softness of the pencil and the breadth of the mark, of course.

The assayer having completed his work, reports the fineness of the bar and the clerical force gets busy on the calculation of its value. Knowing the weight of the bar and the proportions of gold and silver it is a mere matter of figures to arrive at its value. This done, you are given either a check or United States coin upon surrendering the receipt which was given you when you deposited your bullion.

The International Carat Adopted by American Jewelers

By the adoption of the international metric carat for weighing precious stones and gems the American jewelry trade has taken an important step toward much needed uniformity and a single system of international weights and measures. This action was taken at a meeting held in New York on October 29th, at which were present representatives of the largest American firms. The resolutions adopted provided for the use of the international carat after July 1st, 1913, and requested the Secretary of the Treasury to employ this standard in levying the duty on imported diamonds and other gems. The international carat is 200 milligrammes or one fifth of a gramme (3.086 grains), and is now in use in France, Germany, and practically all countries except the United States, Great Britain, Belgium and Holland, where various carats corresponding approximately to 205 milligrammes are employed. It was established in response to a demand of dealers in precious stones in Germany in 1905, which was immediately supported by similar interests in France and other European countries. The carat, which originally was based on the weight of a seed, taking its name in fact from the Arabic word *carob*, meaning bean, never has been uniform or defined with scientific precision, and at the beginning of the twentieth century there were in use at least 20 different carats ranging from the Bologna carat of 188.5 milligrammes to the Arabian carat of 254.6 milligrammes. Hitherto American jewelers have used a carat corresponding to 205.3 milligrammes or approximately that of the British Board of Trade and of the jewelry trade of Antwerp, and dealing as they do with merchants in many foreign centers of trade the diversity has often proved most annoying. With the international carat not only will this lack of uniformity be done away with, but it will be possible to employ decimal sub-divisions instead of sixteenths, etc., and the actual weights for the balances can be made of the highest accuracy and referred to definite and legal standards. This action is quite in line with the general tendency in metrological reforms and attempts at uniformity, where it is found that the most satisfactory progress now can be made by taking a customary unit and defining it in terms of the metric system.

Inauguration of Emperor William Institutes

By Our Berlin Correspondent

TWO of the scientific institutes founded on the initiative of the German Emperor have been recently inaugurated in the presence of the sovereign and a brilliant circle of scientists. These new headquarters of physical science, installed within the boundary of the former royal domain at Dahlem, near Berlin, are destined to play an especially important part in the history of German Science, being the first large German institutes to have been founded at least partly with the means contributed by private persons and where the men of science will first have an opportunity of giving themselves up exclusively to free research work, untrameled by the duties of university teaching.

These two grandiose establishments are the Emperor William Institute of Chemistry and the Emperor William Institute of Physical Chemistry and Electrochemistry; they are housed in an extensive group of beautiful cottages situated close to the terminal station of the Wilmersdorf-Dahlem Electric Subway now under construction. The Institute of Chemistry will be under the management of Dr. Beckmann, late professor of Leipsic University, who will be permanently assisted by Dr. Willstätter, late of Zürich University, well known for his researches on chlorophyl, and temporarily by Dr. Hahn, the eminent specialist in the field of radium and thorium research. The Institute of Physical Chemistry and Electrochemistry will be under the direction of Dr. Harbor, called away from the Carlsruhe Technical High School and who has made a name for himself by his recent synthesis of ammoniac.

In his address, the Emperor announced his intention of inviting the co-operation of chemical science in searching for prophylactic measures destined to protect the men working underground against mine catastrophes.

Dr. Harnack, president of the Emperor William Society, in his speech, announced the forthcoming foundation in Rhenania, with funds contributed by the city of Mülheim, of an institute for coal researches. It would be desirable, Dr. Harnack said, if every great city of the country in its turn founded an institute of scientific research. A clinical radium institute destined to investigate the influence of radium emanation on the human organism in a healthy morbid condition would, by the way, be founded in the near future, and the Emperor William Society also intended to promote aeronautics and aviation in their theoretical foundations. The society further saw one of its main tasks in the promotion of biological investigation, for which purpose the zoological station of Rovigno had been purchased. Other institutes to be founded included an institute of experimental therapeutics and an institute of the physics and hygiene of work, where the beneficial or detrimental influence of work on the human organism and the preserving and increasing of its working capacities would be investigated. The society also co-operates in the excavations of Samara and has helped in organizing an expedition for the fighting of sleeping sickness in New Cameroon.

The funds of the Emperor William Society amount to the total of $3,200,000.

Luc Bink—A Plant that Produces Textile Fibers

THE use of the plant known as Luc Bink for producing textile fibers is the subject of a communication made by the French scientist, Perrot, to the Chamber of Commerce of Saïgon, and his report on the subject is of interest from a commercial standpoint as being of a nature to develop the industry in Indo-China. The plant is of an aquatic variety to which the Annamites give the above name, and its botanical name is *Ecchornis crassipes*. What is remarkable about this plant is that it spreads very rapidly, so that within a short time it covers small ponds and even large lakes. It is said that a single stalk grows in a few months so as to cover a surface of 700 square yards. It appeared in Cambodga in 1902 and seems to have come from Java or the Philippines, or perhaps from Japan, and since that time its growth has been so remarkable that the authorities are becoming alarmed about it on account of the hindrance to navigation. They advise the natives to pull it up and burn it on the shore, and the Battanbang province has already devoted a good sum for this purpose. M. Perrot observed that the plant had strong fibers which could, no doubt, be used for textile purposes. After stripping the leaves, he put the stalks in a Duchemin machine so as to obtain the fibers, and after drying in the shade he found these to be in good condition and of supple nature. He was able to make rope and string or coarse thread with which matting or canvas could be woven. A solid and elastic furniture backing can be made of it so as to replace cane seating for chairs. A most practical use of the threads will be to use them instead of jute for making rice sacks, and these are now used in great quantities in Indo-China. Using a Cambodgan loom he produced a strong and flexible fabric, which was at least as stout as jute bagging. With the same height and width, the sacks have the same weight as jute sacks, but he found that the weight could be reduced by treating the fibers with a chrome alum bath, and this acts to tighten the fiber and close up the pores so as to render it anhydrous. The fibers will take any kind of dye, and as to the breaking strain, he found that a 0.2 inch cord of 3-foot length would support a weight of 100 pounds with an elongation of 4 inches. According to his process, 200 pounds of the green stalks, after removing the pulp and dying, will give about 9 pounds of good fiber ready for use, and this process can be carried out by the natives. The fiber could be baled in the usual presses so as to export it in small bulk to the European cord factories.

The Tehuantepec Railway

THE Tehuantepec Railway, opened in January, 1907, has, according to article in *Weltverkehr*, vastly outstripped its rival, the Panama Railway, and will probably not be seriously affected by the opening of the Panama Canal. In the year ended June 30th, 1911, the traffic over the Tehuantepec route was nearly threefold that over the Panama route. The excellent terminal ports, Puerto Mexico and Salina Cruz, are visited by 20 steamship lines, besides the fleet of steamers maintained by the railway.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Recent Wreck on the N. Y., N. H. & H. R. R. at Westport, Conn.

To the Editor of the SCIENTIFIC AMERICAN:

The article published in your issue of October 26th, 1912, upon the recent wreck at Westport is so unfair in its presentation of the case, and so faulty as to facts, as to demand an answer, and I assume that you would prefer that it be made in your own columns, and that you will not refuse space for this purpose.

The technical character of your journal confers upon its articles greater weight than accorded those in the non-technical press, and the reputation of the New Haven Company with the traveling public should not have been assailed without first having exhausted all reasonable sources of information as to the accuracy of the published statements of facts.

The plain facts brought out in the course of the hearing held by the Interstate Commerce Commission made evident the unusual simplicity of the case, which was unclouded by controversies as to facts or by adverse testimony.

A fast express train running at a speed between fifty and sixty miles per hour traversed a No. 10 crossover between adjacent tracks and was wrecked. For reasons which the unfortunate death of the engineer makes it forever impossible to explain, the time card rule, requiring a reduction of speed to fifteen miles per hour on all "crossovers," was neglected. Without reducing speed, the engineer successively passed the distant signal 3,700 feet from the crossover, which was set at caution; a drawbridge, over which a maximum speed of 30 miles per hour was fixed by the rules; a worktrain conductor and signal towerman, who were both vainly trying to attract his attention; a section foreman standing directly ahead on the same track, frantically endeavoring to "wave him down;" a home signal set at danger, and finally a "dwarf signal" permitting the use of the crossover only at speeds not exceeding 15 miles per hour, with the inevitable and disastrous consequences.

In short, the engineer "ran by his signals," an occurrence which is lamentably frequent, and always most dangerous.

The most searching inquiry failed to disclose any weakness of track, failure of signals or faulty train equipment. The experienced inspectors of the Interstate Commerce Commission and of the Public Utilities Commission of Connecticut have inspected the track, signals and equipment, without suggesting a fault at the subsequent public hearing held in New York.

In the previous article the New Haven Company is directly charged with the maintenance of unsafe crossovers in its track, and general neglect in the conduct of its operation. The article was written without previously ascertaining the conditions and character of the crossovers on the New Haven road, and had the writer followed the accepted practice of reputable journals in previously submitting a proof to the railroad company for criticism and comment, he would have been given a schedule showing the large number and unusually high proportion of long crossovers (No. 15) already installed in the main line tracks between Boston and New York, and would have been informed of the existing standing orders to replace all the shorter crossovers whenever practicable, and as rapidly as possible, following the previous accident at Burr Road.

This sapient critic, who doubtless derives his knowledge from some relative "in the railroad business," secures the use of your columns, and proceeds to draw bizarre and alarming pictures of some unrecognizable parts of an engine, indulging in all the unruly gyrations of an untamed Western bronco, and after showing just how the engine must have left the rails on the curve, indicates in his subjoined sketch that the derailment occurred, in fact, on the main line track, some 90 feet beyond the end of the crossover.

Attention is called to the pronounced "jog" in the crossover curve, which it is explained indicates careless maintenance, but without explaining that the picture was taken *after the wreck*, and without commenting upon the surprisingly good condition of the track, which, while designed for train speeds of fifteen miles per hour, almost passed in safety a train at sixty miles per hour. How many cases has the writer seen in which a crossover was left in such good condition as in this instance?

He cites the short crossovers of the New Haven road in disparaging contrast to the long crossovers of the Pennsylvania and New York Central companies, but says nothing of the percentage of long to short crossovers in the tracks of any of these railroads, leaving it to be inferred that the New Haven Railroad is the sole and exclusive depository of a special brand of short crossovers, not enjoyed in common by the other railroads of the United States. From his inner consciousness he evolves a new variety of crossover unknown to the railroad world, which, in his own words "can be made absolutely safe for the fastest speed at which an engineer can pull his train through them."

He asks if our witness does not "know that on that road (P. R. R.) there are crossovers which are so easy in curvature and of such great length that the railroad has imposed no speed limit whatever upon the engineers in running over them," which would be humiliating had we not been previously informed by Mr. L. R. Zollinger, Engineer of Maintenance of Way for the Pennsylvania Railroad Company, that the longest crossover on the Pennsylvania Railroad was No. 20, and that with one exception the maximum speed permitted by the rules of his company on all crossovers longer than No. 14 is 35 miles per hour, and 15 miles per hour on all other crossovers; and had we not been informed by Mr. A. T. Hardin, Assistant Vice-President of New York Central & Hudson River Railroad Company, that a maximum speed of 30 miles per hour was allowed by his company on the maximum crossover (No. 18), and then only under special notices in time-tables, the speed on all other crossovers being limited to 10 miles per hour. Curiously enough, both of these gentlemen seem to be without access to the wealth of knowledge regarding their own lines so brilliantly displayed by our critic.

It is news to all signal engineers that an automatic train stop device has been perfected which will stop a train on a "clear route" set for a crossover, and it may possibly be news to our editorial critic that the Board of Train Control appointed by the Interstate Commerce Commission, with the aid of a Government appropriation, and after several years of experimentation, failed to find a single automatic train control system which met their requirements, or which was specifically recommended for adoption by the board.

It is contended that the existence of a longer crossover at the scene of the wreck would have averted the consequences of the engineer's disregard of orders and signals, which is possible, but not probable; but unfortunately for the peace of mind of the railway managers, no clew is afforded as to the particular kind of buffer or bag scoop devised to catch trains which may pass the adverse signals at railway grade crossings, or open drawbridges, and which may leave the "derails" at speeds of 60 miles per hour or more. The wrecking of a train disregarding signals at a crossover should not be regarded as a crime in contrast to the intentional wrecking of a train at crossings and drawbridges, which is accepted good practice, and no essential distinction between the two cases is apparent.

Then follows the conclusion expressing the familiar and stereotyped hope for "early and drastic legislation." There is every reason to believe that this hope will be realized, and past experience permits an accurate forecast of its form, which will be substantially as follows:

Federal, State and Municipal Commissions will be multiplied, with extended powers, on which, under no circumstances, will the railways be granted representation, which will contain no member suspected of railway affiliations, nor any one possessing practical and specific knowledge of the subjects to be considered.

The guilt of the railways will be assumed in advance, and the burden of proof to the contrary will rest upon the said railways. The right of appeal will be denied, and the courts of appeal abolished. (N. B. To hell with the Constitution.)

The payment of dividends to its stockholders by any railway company within the period of ten (10) years next preceding the date of any suit or action for damages brought against it shall be considered *prima facie* evidence of guilt on the part of the said railway company, and judgment entered accordingly.

A degree of foresight in the prevention of accidents will be required of the railways, which will at least equal the "hindsight" of the investigating board after each accident.

It shall be the duty of the new and enlarged boards to require the installation of all possible forms of new, untried, complicated or costly mechanical and electrical devices of a character adapted to provide against the most remote contingencies. Two or three million safe operations will not be allowed to excuse one failure, and if necessary to insure this degree of protection, the roadbeds must be festooned with mechanical garlands, to even the exclusion of the sun's rays.

All track-ties must be replaced annually. Engineers will not be expected to regard signals, but nothing in the act shall be construed to relieve any railway company from full responsibility for the acts, failures or omissions of its employees; strikes, riots, floods and acts of God to the contrary notwithstanding.

No crossover shall be shorter than the longest crossover in service on any adjacent railway, regardless of limiting local conditions, and all crossovers, sidings and industrial spurs diverging from switches in main tracks shall be constructed in such manner as to permit the safe passage of trains "for the fastest speed at which an engineer can pull his train through them."

A penalty not less than $10,000 and not more than $50,000 will be imposed for each and every "jog" in track, occurring as the result of a previous train wreck.

The immediate and simultaneous replacement of all passenger equipment by steel cars to an amount not exceeding $1,000,000,000 will be prescribed.

The special boards to be created or extended under the terms of the act will be prohibited from extending aid or assistance to the railways, tending toward the restoration of their lost control of operation, affecting the safety of the traveling public, nor will they be permitted to read the chapters on Preventable Accidents by Mr. James O. Fagan, in his "Confessions of a Railroad Signalman."

The "human equation" shall not be investigated to the political detriment of the party in power.

Adverse judgments must invariably be rendered against the richest and most responsible corporation included within the field of inquiry, always excluding organizations and individuals having votes or slender resources.

In compensation for any additional burdens that may be imposed under the terms of the act, the railways will be permitted to reduce their rates in the proportion of 10 per cent decrease in rates for each 20 per cent increase in the amount of the burdens so imposed.

Boards of investigation should conduct the examination of witnesses primarily for the benefit of the "yellow press," keeping in mind the secondary importance of developing the fundamental causes of train wrecks and means of prevention.

In the investigation of train wrecks by the boards, no apparent lack of evidence unfavorable to the railway company should be accepted as conclusive. The public demands that an example should be made in such cases, and it is the plain intent of the law that such boards shall earn the salaries paid them by providing a victim under all circumstances.

Railways will be required to employ complete duplicate staffs of operating officials in order to insure the safe conduct of operation during the absences of the regular staff in attendance at the hearings before the duly appointed boards, and all such officials will be expected to memorize all forms of statistical data, rates, car numbers, way bills, equipment lists, dates and details of contracts or other records for the convenient use and information of the examining board.

The press will be injoined from publishing any evidence which may seem to favor the railways, and no technical journal shall be required to check the accuracy of its statements in advance of publication.

This forthcoming "drastic legislation" will certainly be popular with the general public, and following previous precedents there can be no reasonable doubt of its passage. There only remains to be added the enacting clause and date to make the bill complete.

E. H. MCHENRY, *Vice-President*,
N. Y., N. H. & H. R. R. Co.

[Comment on the above letter will be found on our editorial page.—EDITOR.]

Our Backwardness in Aviation

To the Editor of the SCIENTIFIC AMERICAN:

In answer to your editorial, "A Promise Unfulfilled," in the edition of September 21st, I suggest that the trouble is in the temperament of the people. They continually read of the aeroplane as being a great factor in war, and as it is scarcely ever heard of in any other connection, they get the impression that it is of no use otherwise. As the American people are fast losing all warlike proclivities as being unnatural and inhuman, they turn from things so distasteful to their views of reason and justice. A. A. HANSMAN.

Colorado City, Colo.

The Temperature of Bread Dough

To the Editor of the SCIENTIFIC AMERICAN:

Why not "do it in your head"? Multiply Centigrade by 2, deduct (10 per cent) 1/10, and arbitrarily add 32.

The boiling point of Centigrade, 100 degrees, multiplied by 2, gives 200, deduct 1/10, 180, add 32, and you get boiling point 212 deg. Fahr.

Centigrade $10 \times 2 = 20 - 1/10 = 18 + 32 = 50$ deg. Fahr., a very simple sum in mental arithmetic. Everybody may know the above, but if there are a few who do not, the above plan may help.

And while we are on temperatures, if a domestic scientist wants to "set" her bread at a given temperature, say 80 deg. Fahr., she multiplies the sought-for temperature by 3, which gives 240 degrees. Then adding the temperature of the kitchen, say 75 degrees, to the flour, say 65 degrees, we get 140 degrees, and deducting same from the first gross temperature, 240 degrees, we get 100 degrees, which is the proper temperature for the *added liquids* to make a dough at 80 deg. Fahr.

Point Loma, Cal. CHARLES CRISTADORO.

The Mining of Herculaneum

A Splendid Opportunity for the Archeologist

By Professor Alfred Emerson, Art Institute of Chicago

AN American explorer of large experience and fine spirit, Dr. Charles Waldstein, has advocated a complete, final disinterment of Herculaneum, the buried Roman city at the foot of Mount Vesuvius, by international subscription. The Italian government has lent a favorable ear to part of the Cambridge professor's proposal. It has decided to employ capable mining engineers on that enterprise, who will conduct it with pneumatic rock-cutters by electric light, instead of elbow-grease and torchlight. But it has rejected the co-operative feature. Short of cataclysms like the Messina earthquake, Italy prefers not to pass the hat. And Italy holds all the dice in the proposed archeological game. So far so good. Unfortunately, the problem has only been navigated back to the starting point. No sooner had the national government given a new twist to the comatose underground exploration in 1908 and 1909, than litigation arose over the compensation of real estate holders in the modern cities of Portici and Resina, which crown the lava beds above ancient Herculaneum. Courts are slow and timid. Resina will not relent.

Prince d'Elbeuf discovered the remains of the buried Campanian town by accident in 1719, under his country seat at Portici. The impending bicentenary of that event promises to be a sorry celebration, with nothing done to revive the torpid enterprise. Archeology will not languish on account of Mr. Waldstein's disappointment. But Italy might cease to be its chief nursery hereafter. The world will give its better attention, as scholars are already doing, to French Africa and Egypt, to the isles of Greece, and above all to that eastern half of the vast Roman empire which Strzygowski has christened the virgin soil of art history—to Asia Minor. Herculaneum will please stay dead!

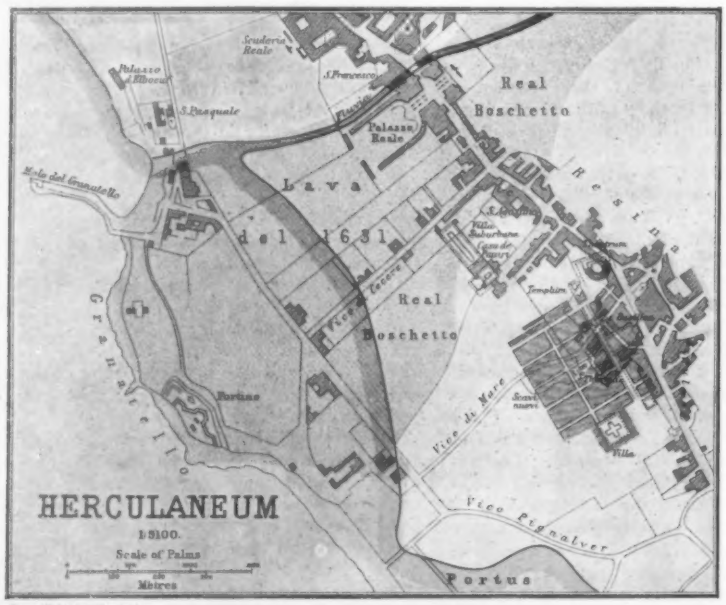
The mysterious underground city somehow refuses to do this. Its strange rediscovery is too closely interwoven with the rebirth of intelligence, and of modern history itself. Let us see if this is not so.

The resurrection of Herculaneum and Pompeii in the eighteenth century took the imagination of all Europe captive. The dead occupants of the two Vesuvian ports conquered the modern heart. To be exact, all the new and near glimpses of classical antiquity that were thrown open toward 1750 and after worked together. Stuart surveyed the antiquities of Athens. Rome gave up a harvest of statues. A great Italian engraver portrayed the majestic ruins of the imperial city in a thousand noble etchings. "The glory that was Greece and the splendor that was Rome" penetrated philosophy, letters, the arts of design and even costume. Watteau's courtly gallants and powdered belles ceased to please. This convulsion of Europe's taste foreshadowed the later social and political revolution. First Alfieri's "Brutus" and Chénier's "Messenian Odes"; then Goddess Reason, the Consulate and the Corsican Cæsar.

A clever Frenchman has described the beginnings of modern neo-Greek and neo-Roman art under the caption "Empire Art Under Louis XV." He proclaims Piranesi its founder. Other big stars in the new art firmament bear familiar names: Wedgwood and Flaxman, David and Percier, Canova and Thorvaldsen. The classical wave reached America. From Maine to Missouri, Grecian porticos still add dignity to the manse and majesty to the county magnate's mansion.

A long and singular oblivion overtook Herculaneum and Pompeii after their volcanic burial in the reign of Titus, A.D. 79. The refugees from the nearer suburb obtained the freedom of Neapolis, the Græco-Roman Naples. Posterity forgot the buried towns, although the Greek and Latin writers who relate their history were easy of access and both places lay close to a busy highway. One stroke of the pick was enough to betray the secret of Pompeii's underground survival. Its old hilltop temple of Hercules and its tall amphitheater were, in fact, never buried at all by the cloud of light pumice stone which fell on that section of the shore. Farther west, a deluge of volcanic mud filled every cranny of the sister city. This blanket of wet volcanic cinders hardened to a stratum of solid rock, and is crossed only on top by lava streams of much later origin. The resultant condition is a sixty-five-foot stratum of very hard natural concrete and lava between the antique and the modern street levels, as against eighteen feet of loose, light gravel at Pompeii, with upper stories of submerged constructions outcropping.

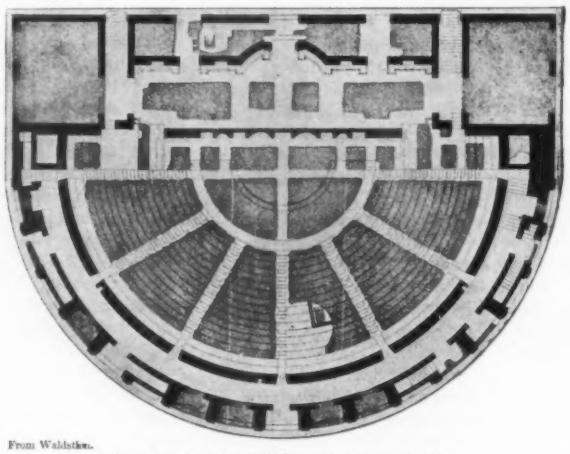
In spite of all this, Herculaneum was tapped first. A princely foreign resident of Portici sank a well on his grounds, as we have seen. As luck would have it, his men penetrated through recent lavas to the heart of a lofty antique structure which was embellished with many statues of white marble. Prince d'Elbeuf extracted twenty columns of colored stone and ten or a dozen gracefully draped female figures from the theater and contiguous ruins. Some of these were afterward identified as the daughters of Nonius Balbus, the builder of the municipal court-house. Elbeuf astutely presented three of his statues to Austria's popular mili-



From Waldstein-Shoobridge.

Beloch's plan. Reduction 0.28.

Note obliteration of antique shoreline by modern lava flow, the royal palace and park, the underground sites, *casa dei papiri, theatrum, templum, basilica,* baths (*thermæ*) and the recent excavations (*scavi nuovi*)



From Waldstein.

Ruggiero's plan of Herculaneum theater.

Note scene and proscenium walls, and Prince d'Elbeuf's open well mouth.

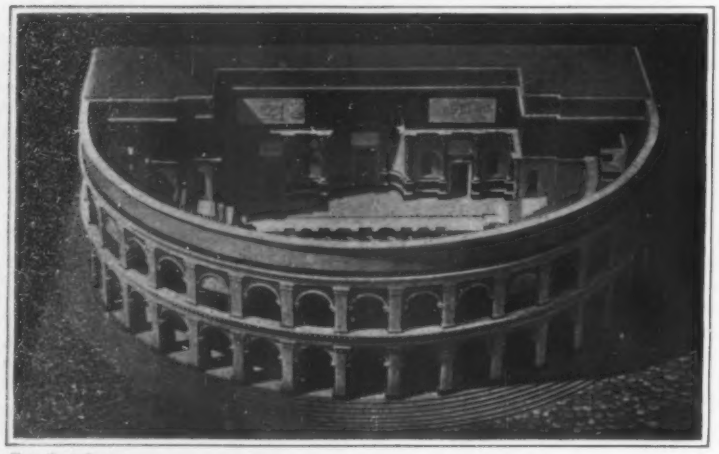


Photo. Giorgio Sommer.

Model of Herculaneum theater on view at Resina.

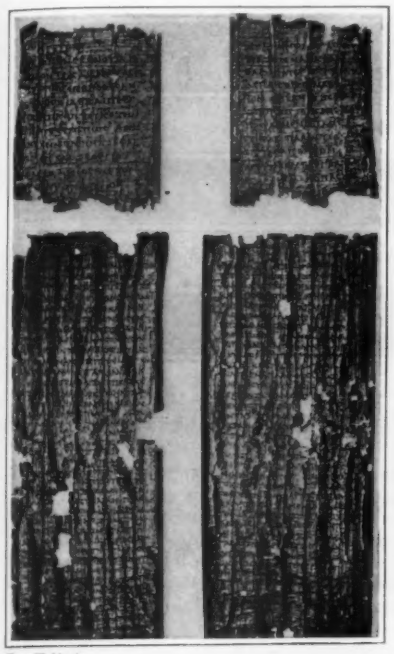
Photo. Giorgio Sommer.

Reassembled bronze horse from peak of theater.

THE MINING OF HERCULANEUM

tary hero, Prince Eugene. Austria ruled Naples at this period. Its local authorities, however, confiscated the remainder of Elbeuf's marble harvest, and stopped his burrowing, without pursuing the work on government account. The Elector of Saxony bought the Vienna figures of Eugene's estate, and they are at Dresden yet.

Twenty years later, Naples is a Spanish secundogeniture, and King Charles, who afterward became Charles III. of Spain, is laying out a summer palace on the site of Prince d'Elbeuf's old chateau. His architect opened another well, or shaft, hoping to quarry horses they found in position on that architectural eminence. Their royal master proved equally brilliant. Part of the crumpled bronze quadriga was idiotically converted into bas relief portraits of the king and queen, and church furniture, although the heads of these brazen steeds surpassed those of San Marco at Venice! The bronze fragments were allowed to lie in a corner of the palace yard, a prey to passers-by, for many years, even after an able artist, who was summoned from Rome, had managed to rebuild one composite animal with the remains of all. All Naples the new shafts. Unpropped rock ceilings and walls fell in and endangered the modern town overhead. Alcubier's activity and petty jealousy were a burden to his abler Swiss and Italian subordinates until his death in 1780. But no trained expert was ever more fortunate in his digging, and the king stood by him while the crusty old captain filled his palace with the spoils of Herculaneum. A Roman basilica or courthouse 250 feet long, close to the theater, yielded some fine imperial portraits of the Augustan era, and two marble equestrian portraits of Herculanean noblemen.



From Waldstein.

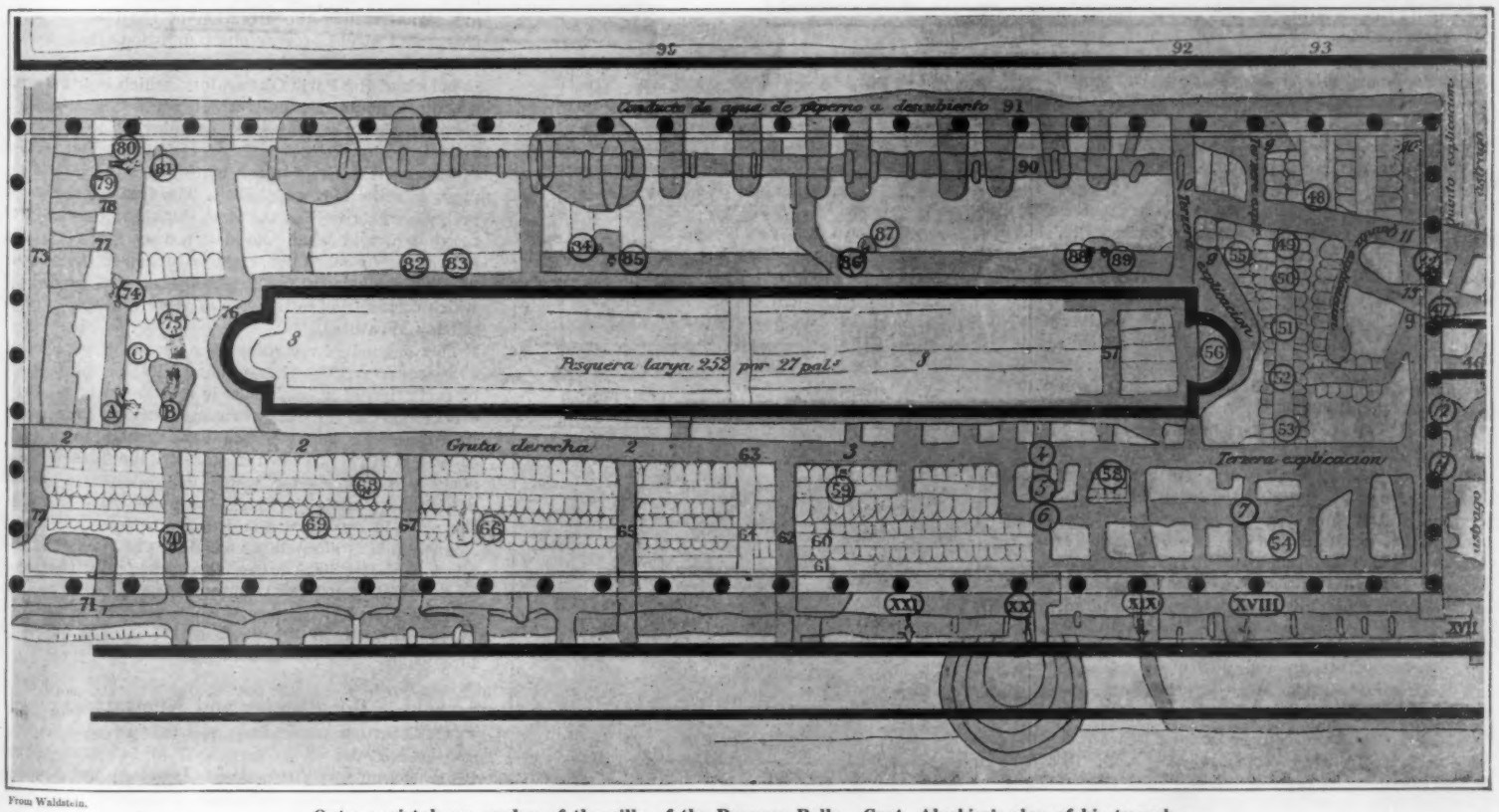
Metrodorus on the senses and Philodemus on signs, found in the villa of the Papyrus Rolls.

Photo. Sommer.

Marble Pallas Athena found in tablinum of villa, near 46 on plan. Greek style of about 490 B. C.

Photo. Sommer.

Wrestler or disk-thrower. One of a pair found at 74 and A on plan.



From Waldstein.

Outer peristyle or garden of the villa of the Papyrus Rolls. Capt. Alcubier's plan of his tunnels.

Note passage to inner peristyle at 46, Alcubier's main shaft at 2, 3, 4, 11, his refilled scoops at 48 to 70. Also, bronze statues in sites at A, B, C., etc., and the 220-foot fishpond. Nearly all the statuary of the villa was recovered in this garden.

THE MINING OF HERCULANEUM

broken antique marble from it for the royal limekiln. Alcubier, the king's master of the works, was more of a soldier than a scrivener. His Spanish diary of the dig is quaint reading. Naples, as Shakespeare would have called Charles, was very lucky. The diggers happened this time on the topmost pinnacle of the old theater, with a big Latin inscription on it that identified the building as a public monument of the long-lost Roman town. But the king's incapable servants never quite made out whether it was four or six gilt bronze laughed at the curious medical attentions this brazen horse required. After every hard shower, the castle gates were closed for the king's steward to empty its belly with a pump.

The same incompetence governed the tunneling operations. The royal excavator bored only for artistic treasures of a portable nature, like statuary and fresco paintings or mosaics. Little attention was given to the architectural relics or to the planning of buildings. Old shafts were choked up again with the rubbish of A rectangular temple yielded several Greek monochromes on marble and four big mythologies in fresco.

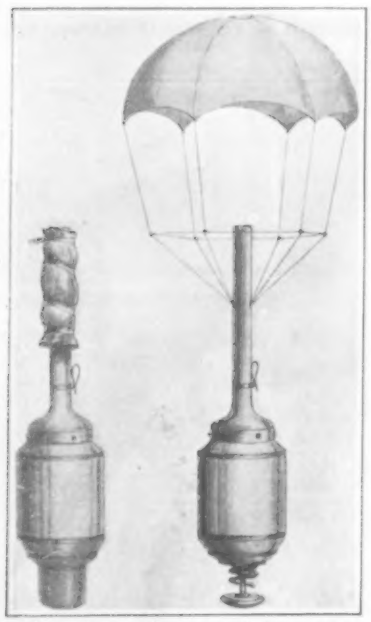
In the fifties Alcubier worm-holed a vast private mansion, a regular Roman palazzo, with horizontal shafts. Comparetti and De Petra have almost proved, in a recent monograph on this building and its contents, that its first owner was one of the illustrious Pisones, and once the Roman governor of Thrace. Horace dedicated his "Art of Poetry" to this man's descendants,

(Continued on page 428.)

A Parachute Bomb for Aeronautic Use

SINCE airships and aeroplanes have been added to the military equipment of nations, the want of bombs really suitable for launching from these aerial vessels has been keenly felt. The bombs that have hitherto been used for this purpose have one or more of the following defects:

1. When a bomb which is exploded by impact is



Aasen's parachute bomb for aeronautic use.

thrown from a great height it acquires, in falling, a velocity sufficient to bury it so deeply in the earth, before the explosion occurs, that its lateral action is annulled, because all of its projectiles are discharged underground instead of scattering and carrying destruction in every direction over the earth's surface.

2. A bomb dropped from a moving airship has initially the horizontal velocity of the vessel, which may exceed 60 feet per second. Hence the bomb will not fall vertically on the object aimed at, but will descend obliquely and strike the ground at a distance from its goal that cannot be calculated with accuracy. The effect of the explosion, furthermore, may be diminished by two thirds, or more, by the obliquity of the axis at the moment of explosion.

3. The projectiles share the vertical velocity acquired by the bomb in falling from a great height and are therefore discharged, not horizontally, but obliquely downward into the earth. Hence the useful effect would be annulled even if defects 1 and 2 did not exist.

4. When the bomb is cleared for throwing, its safety catch or cap is released or removed. Under these conditions a misdirected throw or other accident may precipitate an explosion which would seriously injure or even wreck the airship.

In Aasen's bomb these defects are remedied in the following manner:

1. The bomb has a very sensitive contact exploder which produces an explosion the instant its tip touches the softest ground, or even a water surface. Hence the bomb cannot penetrate the earth before exploding.

2. The bomb is provided with a small parachute which quickly destroys the horizontal velocity communicated by the airship. The bomb, therefore, falls vertically on the spot over which the airship is passing, and its axis remains vertical, so that the projectiles are discharged horizontally in all directions and produce the maximum effect, throughout an area of more than 8,000 square feet.

3. The parachute can be arranged to limit the vertical velocity of the bomb to 100 or 200 feet per second, as may be desired. These velocities produce no appreciable effect on the paths of the projectiles, as the exploding mechanism is contrived to counteract their influence.

4. The exploding mechanism is so constructed that it cannot act until the bomb has fallen 66 feet. Hence the bomb cannot explode in or near the airship.

The bomb, when loaded and ready for use, weighs about 11 pounds and contains 400 projectiles, which have an effective radius of action of at least 80 to 100 feet from the point of discharge. The weight of the explosive charge is about one pound.

These bombs are designed for use against detachments of infantry, cavalry and artillery. Very much larger explosive charges must obviously be employed for effective attack upon warships and fortifications. —Translated for the SCIENTIFIC AMERICAN from *Kriegstechnische Zeitschrift.*

Using a Frog's Leg as Wireless Telegraph Receiver

By Our Berlin Correspondent

GALVANI'S well known experiment, which in spite, or rather because, of its being wrongly interpreted, gave rise to the development of galvanic electricity, has become a familiar classroom demonstration, especially in lectures on physiology. A peculiar use has been recently made of the phenomenon by adapting it to the recording of electro-magnetic waves such as used in wireless telegraphy.

Dr. Lefeuvre, professor at the Medical High School of Rennes, has, in fact, devised the following arrangement for recording the contraction of a frog's muscle as produced by the passage of an electric stimulus through a motive nerve:

The muscle *M* is solidly fixed in its upper part by means of a pair of tongs, as shown in Fig. 1. The end of the sinew is connected by means of a wire to a light lever *L* pivoted at *O*. This lever is returned to its initial position, after the contraction is completed, by a weight suspended from it, and the end of the lever, which carries a fine point, bears against a rotating smoked cylinder. At the very moment the muscle is excited through the intermediary of its nerve *N*, the contraction curve, enlarged by the lever, is recorded faithfully on the smoked cylinder. While many cold-blooded animals can be used for this experiment, the muscles of frogs' legs are particularly well adapted for the purpose, on account of the regularity of their form, the long duration of their excitability and the special ease with which they can be severed from the body.

So far from severing the muscle completely from the body of the animal, it is, however, preferable to leave it in position, cutting the "Achilles" sinew at its junction, and fixing it to the wire connecting with the lever. In this case, the central nervous system of the animal should, however, be destroyed, lest the experiment be disturbed by motive reflexes. The sciatic nerve is dissected over a short distance at the level of the thigh, and is lifted by means of the hooks of wire supplying the electrical stimulus.

This neuro-muscular apparatus is so extremely sensitive to electric stimuli that it can be used as a sensitive galvanoscope, allowing the very slightest electric variations or waves to be detected. In the arrangement above referred to it further affords the advantage of allowing its readings to be recorded. It can actually be employed in the following arrangement for the receiving and recording of wireless signals.

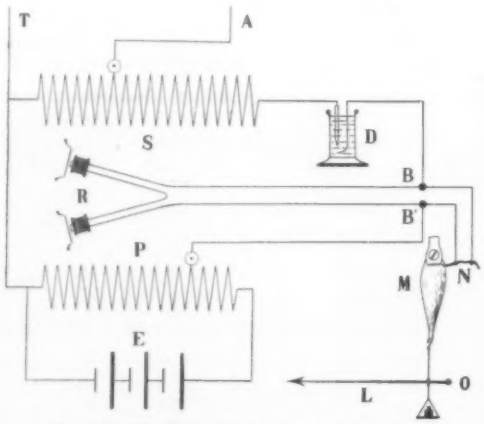


Fig. 1.—Diagram of the receiving station.

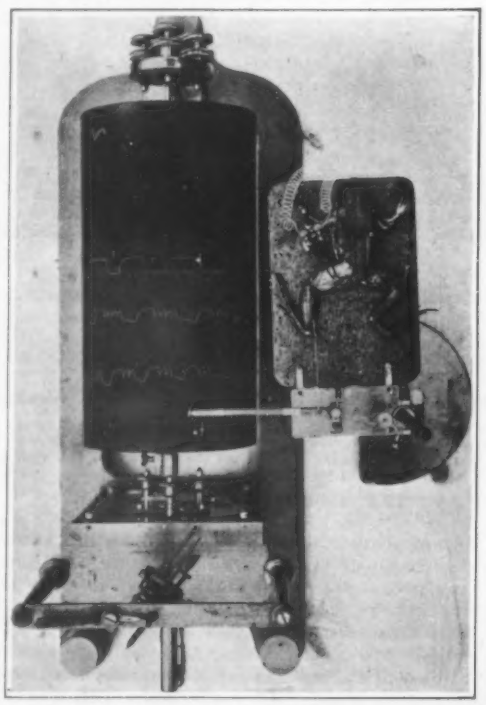


Fig. 2.—Recording a wireless telegraph message with the aid of a frog's leg.

The receiving station (Fig. 1) comprises the following; *E* is a battery of three cells, *P* a potentiometer allowing the voltage in the receiving circuit to be controlled, *S* is a tuning coil to which the receiving antenna *A* is connected, *D* an electrolytic detector, and *R* two high-resistance telephone receivers connected up in series.

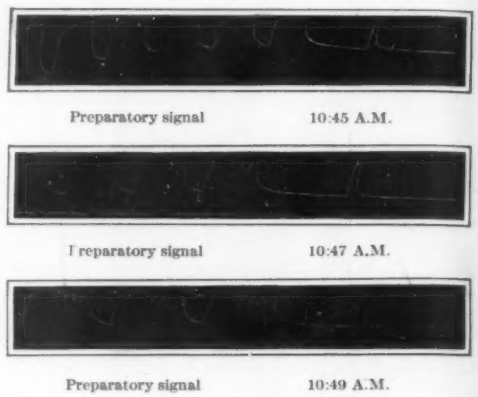


Fig. 3.—Eiffel time-signals recorded by the frog's leg.

To the terminals *B*, *B'* of these telephones are connected, in shunt, two wires applying the electrical stimulus to the nerve *N* through the intermediary of small metal hooks. The excitation of the nerve is due to the self-induction currents produced in the coils of these telephones.

The tracings reproduced in Fig. 3 have been obtained at Rennes by means of the arrangement above described and are records of the time signals given out daily from the radio-telegraphic station of the Eiffel Tower. The distance between Paris and Rennes is about 185 miles. These signals comprise a preliminary signal calling the attention of the observer to a subsequent signal of very short duration which marks standard time. The time markings are sent out from the clock of the Paris Observatory, which is fitted with a contact, actuating the transmission set of the Eiffel Tower. They are sent every morning at 10:45, 10:47 and 10:49, respectively. The preliminary signals are different for each of these markings and can be expressed in the Morse alphabet. The tracings allow the preliminary as well as the time signals to be distinctly recognized, and when choosing a very fine style and only slightly smoked paper, they are seen in their upper part to show very fine indentations, the number of which corresponds to the rate of vibration of the transmitting apparatus.

This method of recording time signals is of remarkable accuracy. The time passing between the moment of excitation of a frog's muscle and the moment of its contraction is, in fact, extremely short. Moreover, this time—the latent period of contraction, as it is called—is a well known factor—in the present case about 0.01 second—for which due allowance can be made. As regards the delay due to the time taken by the wave in traversing the distance between Paris and Rennes, this is absolutely negligible, the rate of transmission of Hertzian waves being practically the same as the velocity of light, viz., 186,330 miles per second.

While this arrangement is an interesting laboratory apparatus, it is hardly likely to become commercially practicable.

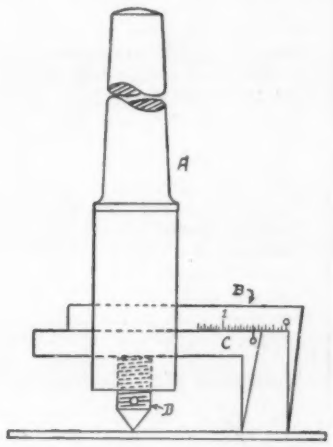
Horse-power and Kilowatt

THE British Association for the Advancement of Science adopted, as early as 1873, 746 watts as the equivalent of the British and American horse-power, and 736 watts as the equivalent of the metric or Continental horse-power, says *Machinery.* In a circular recently issued by the United States Bureau of Standards, it is stated that in all future publications of this bureau the former value, 746 watts, or 0.746 kilowatt, will be used as the exact equivalent of the English and American horse-power. For scientific work, it is quite important to have the horse-power thus standardized by being expressed in the so-called "absolute" system of measurement, because the common definition of 550 foot-pounds per second is scientifically correct only at a certain latitude and altitude, on account of the fact that the pound-weight, as a unit of force, varies in value as *g*, the acceleration of gravity, varies. The horse-power when expressed at 746 watts is equal to 550 foot-pounds per second at 50 degrees latitude and at sea level.

A Tool for Cutting Gaskets

By H. D. Chapman

THE accompanying sketch shows a gasket cutter of inexpensive construction, which may be adjusted to cut gaskets of any desired size. The shank *A* of the tool is made of machine steel and tapered to suit the drill press spindle. The body of the tool is slotted to receive a pair of cutters, *B* and *C*. These cutters are made of tool steel, and one of them is graduated in sixteenths of an inch, as shown in the illustration.



Gasket-cutting tool.

This permits one to tell what size of gasket he is cutting. In the lower end of the body of the tool a setscrew *D* is threaded. This is adapted to bear against the two cutters, holding them in position. The setscrew has a one eighth hole drilled through it, so that it may be tightened up with a pin. The outer end of the screw is turned to a 60-degree cone point. In use, this point is sunk into the material, and the tool is revolved about the center, cutting out the gaskets. This tool will be found suitable for cutting gaskets from any material with the exception of metals.

Welding Extensions on Small Drills

By Nathan C. Johnson

A NECESSITY of very frequent occurrence in practically every workshop is the lengthening of the shank of a small twist drill. This is particularly true of the amateur shop; and when the necessity arises of drilling a hole deeper than the length of the shank on the standard twist drill, the problem of welding on an extension is one of serious aspect. Indeed, it may be said that a weld of this kind, particularly if the drill be under 3/16ths of an inch, is a very difficult matter, even for a skilled blacksmith, as it is almost impossible to heat the shank of the drill to a welding heat without spoiling the steel, or drawing the temper in the rest of the drill at the very least.

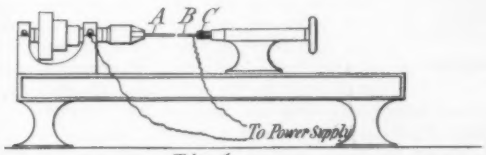


Fig. 1.

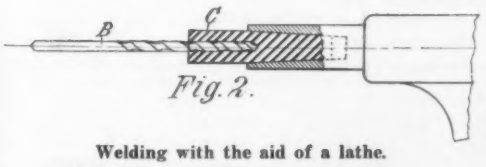


Fig. 2.

Welding with the aid of a lathe.

With the object of overcoming these difficulties, the following simple method of making the weld was devised. It will be seen at a glance from the drawings that the means used was the electric current, but it was impracticable to use a current heavy enough to heat the drill, owing to its resistance, so the heat of the electric arc was employed.

To hold the drill and the extension rod in line and also to regulate the arc, a small bench lathe was pressed into service. From Fig. 1, it will be seen that the extension rod *A* is held in the chuck on the headstock. To this latter is also attached one terminal of the electric circuit. In the tail stock is fitted a plug of hard rubber, or fiber *C*, tapered at one end to fit the tailstock and having a socket at the other of such a size as to hold the drill *B* to be lengthened. This rubber, or fiber, piece holding the drill is to insulate it from the rest of the machine; and the other terminal of the electric circuit is attached to the drill directly.

It will now be seen that if we turn the handwheel on the tail stock so as to bring the extension rod and the drill into contact, we will complete the electric circuit. If then we unscrew the tailstock a little, we shall draw out an arc between the two pieces. It takes but a few seconds to have the two pieces at a melting heat; and if the arc is looked at through blue glasses, it will be easy to determine when this condition has been attained. When the metal is seen to be molten at the extreme tips of the drill and the rod respectively, screw in the tailstock quickly. This forces the two butts together; and after cooling off, it will be found that a most excellent weld between the two has been produced, the electric weld having the added advantage over common welds that it is most sound at the center, with imperfections on the outside, while the reverse is true with blacksmith welds. All that is necessary now is to remove the terminals from the pieces and dress the weld off with a fine file.

Drills down to the very finest can be easily and accurately welded to extensions of any length by this means. There is no roughness to the weld; it is strong; and because of the use of the lathe, not only is the arc under perfect control, but the resulting drill is in perfect alignment—a most desirable quality.

As a source of current, an attachment to an electric light socket has been used for the finer sizes. For larger sizes, it may be necessary to re-fuse the rosette from which the drop is taken; but even for large drills, up to ¼ inch, 2 amperes at 110 volts is amply sufficient.

Workshop Notes

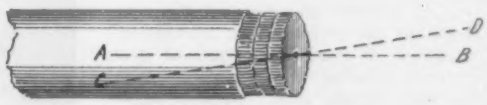
Method of Removing Broken Screws.—In order to get out broken screws, bolts, and short studs, which were not long enough to be gripped with pinchers, gas pliers, or jam-nuts, the writer has successfully used a nut (employing various sizes for various screws) cut through from one side with a hacksaw to form a split nut. The split nut was screwed on the screw as far as possible, then it was gripped in a pair of pinchers or gas pliers in cases of light work or in a clamp or hand vise for heavier work. The nut in turn gripped the screw so that it was easily unscrewed. Such a nut may also be used to hold short round- or flat-headed screws or setscrews while they are cut to desirable lengths with hacksaw or file, which operation is very bothersome, especially if the screw is so short that the part that is to be taken off does not let the wire get a good grip on it.—G. H. Ander.

Non-rusting Treatment for Tools.—All iron tools, such as squares, wrenches, pliers, dividers, screw drivers, etc., have the unwelcome property of rusting. In damp shops the tendency is even more marked. For all such cases as arise with plain iron tools (those not plated or painted) the following treatment will be found to be an efficient preventive measure. Obtain some potassium bichromate (five or ten cents worth will be sufficient for a gallon of solution) and some sodium hydroxide (lye). The water used as a solvent should be distilled and warm or hot if possible. To a gallon of water add about one or two tablespoons of the hydroxide (lye) and after it is dissolved add the bichromate. Make the solution saturated, i. e., put in as much of the bichromate as will dissolve. Since the crystals do not dissolve very fast, the solution should be stirred. Now clean the tools, utensils, or the like which are to be treated. They should be smoothed and polished if possible. Sandpaper or emery paper or cloth will be found serviceable for this purpose. Then submerge the tools in the solution. When several pieces are treated at the same time they should not touch or interfere with one another. The treatment should last as long as possible. This may be for one, two, or more days, or even for several weeks. The tools may be taken out of the solution and used as needed and then reinserted in the solution. In such cases care should be taken to keep the tools clean or else to reclean them. Some tools, as screw drivers, squares, dividers, etc., can be left in the solution continually, day in and day out, and be taken from the solution as needed. This method will keep them bright indefinitely. If the solution evaporates, it can be replaced with more water or bichromate and lye as needed. Ordinary tools can be washed and wiped with a cloth after treatment without destroying the non-rusting effect. This treatment should be very valuable about the shop, and since it does not injure the tool in any way, it is applicable to fine tools as well as the common ones. The action is due to the combined influence of the hydroxide and bichromate, which tends to inhibit and prevent the iron from corroding. The effect wears off in time, of course, but it can be renewed by a further treatment. In fact, occasional treatment at given intervals should render the tools practically permanently immune. The cause of the action is not definitely known. It is thought that the hydroxide acts on account of the OH ions which are freed, and that the bichromate acts to form a protective coat of some sort on the iron, which keeps it from corrosion. This coat cannot be seen, however, even by the aid of powerful microscopes. Since the average worker is more concerned with how it works rather than why, a further discussion of the theory will be dispensed with. The potassium bichromate and the lye can be obtained at any drug store and should be handled with care, since both are poisonous, and one causes burns while the other causes unsightly flesh stains under the condition of moisture on the flesh.—Philip Edelman.

How to Remove Chatter Marks

By William Grötzinger

A SIMPLE method of removing the chatter marks that occur sometimes in lathe work is to grind the tool at an angle, so that its broad edge will keep from falling into the old chatter marks. In the accompanying illustration let the lines *AB* represent the cutting edge of the tool that produces the chattered effect. The chatter marks will then be parallel to the edge of the tool.



Angle of tool for removing chatter marks.

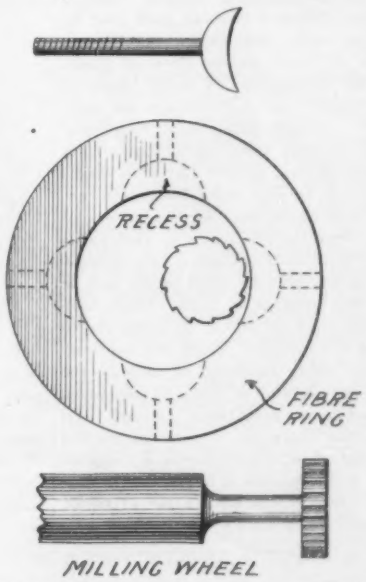
By grinding the tool so that its cutting edge lies in the direction *CD*, the chattered work may readily be removed. This method will be found especially good in turning ironwork.

Improvised Milling Machine

By Louis H. Tolhurst

A SHORT time ago, I found it necessary to replace the fiber in the timer of my automobile. It consisted of a fiber ring about 3½ inches in diameter, about ¾ of an inch thick, and about ¾ of an inch wide. This ring I turned up in the usual way on my small foot-power lathe from an ordinary block of red fiber. When I had done this, I found it necessary to cut four half circles on the inside of the ring, at even distances apart, and about 5/16 of an inch wide, and corresponding in shape to the four steel electrodes which I had removed from the old timer fiber, so that these electrodes could be set in the inner side of the ring, exposing their flat surface flush with the inside surface of the ring.

To accomplish this, I clamped a large cap screw in the chuck and turned the head down to such size and thickness as would exactly fit the cut desired to be made in the ring, turning the shank down to 5/16 of an inch at the same time, as shown in the illustration.



How the lathe was used as a milling machine.

With a half-round file, I cut teeth on the wheel, as shown, being careful to keep the edges of the teeth even with the circumference of the wheel, in this way quickly making an untempered milling wheel the exact size desired to do the work. This took half an hour, no hardening being necessary. The rest was easy. By mounting this little milling wheel in the chuck of the lathe, and clamping the fiber ring with an ordinary wood clamp to the side of a bar of steel mounted in the tool rest of the lathe, the work was done in twenty minutes more, thus using the lathe as a milling machine.

I leave it to the imagination of the reader as to the length of time it would have taken to cut these recesses at all accurately with a cold-chisel. I have since used this little home-made mill to great advantage on wood, hard rubber, babbit, etc., and it has stood up remarkably well; but if the same were made of tool steel and hardened, of course it would serve for a much greater range of uses.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Profile Gage

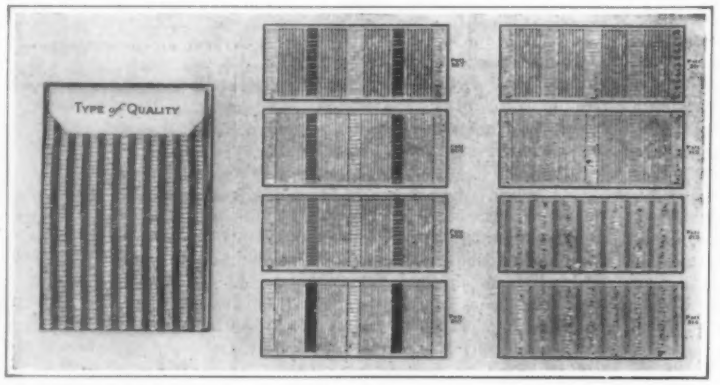
WHEN a carpenter or cabinet maker wishes to fit a piece of board against a molding, or any other irregular surface, he is apt to find his task a difficult one, unless he happens to have a full-size, cross-sectional drawing of the molding. In order to provide a ready means of producing a profile of the molding, an inventor has designed the gage shown in the accompanying illustration. It consists of two plates of pressed steel fastened together with screws to form the body of the gage. Between these plates a series of wires or thin rods are clamped with just enough pressure to make them hold their positions at various points of adjustment. To facilitate the gripping action of the two plates, their edges are corrugated so as to fit about each rod. The manner in which this gage is used is clearly illustrated. It is merely necessary to press the gage down upon the molding, moving each rod down with the fingers as far as it will go against the molding. When the gage is removed the ends of the rods will form a perfect profile of the molding, and this may be transferred to a board by laying the gage down and drawing a pencil along the profile. The wire rods are each one twentieth of an inch in diameter and every tenth rod is of brass, while the rest are of steel. The brass rods thus divide the gage into half inches, which facilitates measuring an object. Thus the width of the molding can be determined by the gage without the use of calipers.

Getting the profile of a piece of molding.

Imitating Cloth Samples With Embossed Paper

NO one who is not directly connected with the business, realizes what a vast sum of money is spent each year by large drygoods dealers in making up samples of their various lines of goods. It is not unusual for a large house to spend twenty thousand dollars on samples for a single line. And frequently over a hundred thousand dollars represents the annual sample bill of a single concern. This may seem incredible, until we understand that large numbers of sample cards must be made up, that yards and yards of material, often very expensive, must be cut into small pieces and be pasted on the cards by hand. These sample cards must go out to drygoods stores all over the country. There are one hundred and eighty thousand of them in the United States, and of these twenty-seven thousand are department stores. Of course, the enormous expense of getting out a line of sample cards for a complete line of goods renders it impossible to supply all these stores with a set of cards. Sometimes it is necessary to start up the mill just to make samples. There are other difficulties. Frequently mistakes are made in pasting the wrong samples on the cards opposite the printed numbers. This will result in the delivery of the wrong piece of goods, and may involve considerable expense.

Recently, an inventor who has had considerable experience in the drygoods business, and also in the lithographing business, conceived the idea of reproducing the samples by making embossed impressions on the card. He devised a method of reproducing the textile fabric so accurately that one can actually count the threads on the embossed paper reproduction by using an ordinary counting glass. Any slight irregularity in the cloth is faithfully reproduced. Even the slightly frayed edges are there. He has shown this work to expert drygoods men, and has completely deceived them into thinking that actual pieces of cloth were pasted on the card. Instead of making up the samples in separate cards, he makes up a complete line in a long folder, something like that of a railroad time table. A portion of one of these folders is shown in the accompanying engraving. On the first page is a piece of the actual material which the buyer may examine critically to test the quality of the line. The different patterns he can select by referring to the samples. As an evidence of the perfection of this embossed reproduction, not only colored samples of cloth are reproduced, but even white goods. Every thread is there and the height of the embossing equals the thickness of the thread.



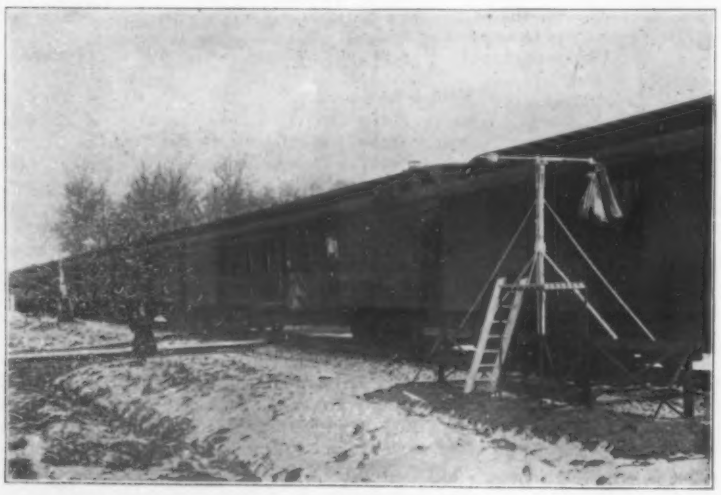
Sample card with embossed printing in perfect imitation of cloth samples.

The paper sample card has been adopted by a number of large merchants in New York city, who find that it cuts down their sample bill fully 50 per cent. They do not have to wait for the material from the mills before making up their samples, but can have them reproduced from the design, and they no longer stand in dread of a mistake on the part of the paster. Furthermore, they can have enough cards printed to furnish every drygoods store in the country if they so desire.

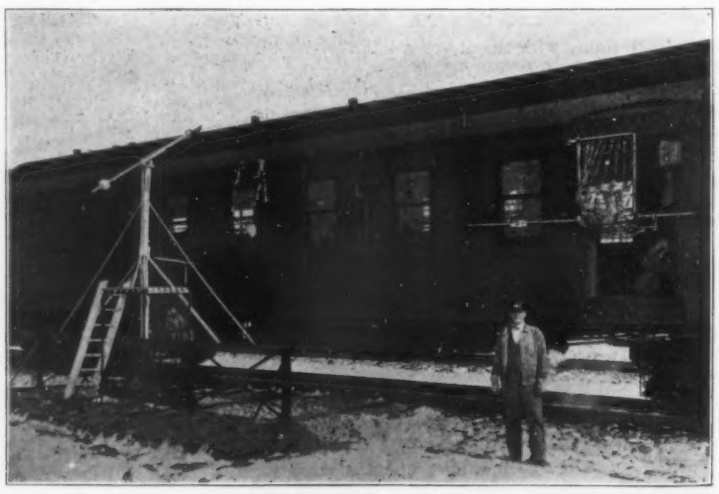
Improved Mail Exchanging Device

SO many accidents have occurred in delivering mail from fast moving trains, and there have been so many failures to catch the mail sacks from the roadside crane, that the Post Office Department a few years ago advertised for inventions that would overcome the difficulties. There were many responses to this invitation from the Government, and two or three of the inventions have already received the approval of the Post Office Department. Among them is the one shown in the accompanying illustration. The device was tried out for a full year on the Illinois Central Railroad and was found to give perfectly satisfactory results.

Attached to the train is a metal frame of rectangular form which forms the mouth of a bag made up of chains. This crane is hinged at one side to a pair of bars across the mail-car door, and it can be moved to either side of the door, depending upon the direction of travel of the train; the lower outer corner of the hinged crane is connected by a rod to an extension of the lower cross-bar and bears against a heavy spiral spring. The mail crane at the side of the track has a single arm instead of two as heretofore, and from this two or more mail bags may be suspended. As the train nears the mail crane the iron frame is swung out to catch the mail bag. The shock is taken up by the chains and by the coil spring referred to. The recoil of this spring throws the device back to the car door with the mail sack in the exchange bag and the mail clerk can then readily draw it out without reaching outside the car door. At the roadside a similar crane and chain bag is supported in proper position to receive the mail bags that are suspended from the lower bar of the mail car as shown in our illustration. The only difference between the roadside device and



The train is about to deliver three sacks and receive two.



Positions of the mechanisms after an exchange of mail.

that carried on the train, is that the former is larger and much more substantial. During the operation of this device on the Illinois Central Railroad, deliveries have varied from a single pouch containing a handful of letters to six sacks and a pouch of 310 pounds in weight. Single pouches practically empty have been caught and also pouches so filled that they could not be strapped in the middle, as is necessary with the old style of hook. All conditions have been met with trains running from three or four miles an hour up to sixty miles an hour without damage to a single piece of mail.

At some of the stations where heretofore it has been the practice to make deliveries ten or twelve hundred feet away from the station, the tracks have been spread, and the device has been located between them directly in front of the depot and under the eye of the station agent.

Adjudicated Patents

AMONG the recently adjudicated patents reported in the Patent Office *Official Gazette*, are the Wilfley patent, No. 590,675, for an ore concentrator which was held valid and infringed in Mine & Smelter Supply Company v. Braeckel Concentrator Company; the Claude and Hess patent, No. 664,383, for an apparatus for storing and distributing acetylene gas, limited as to term by the British patent, No. 29,750 of 1896, granted to the same patentees, which expired by limitation June 30th, 1910; also held not infringed in Commercial Acetylene Company v. Searchlight Gas Company; the Lutz patent, No. 839,-071, for a machine for heating surfaces, held invalid; also not infringed if conceded validity in Equitable Asphalt Maintenance Company v. Parker-Washington Company; the Hood patent, No. 858,070, for a burial crypt, held void because the subject-matter is not within the patent law, International Mausoleum Company v. Sievert; the Spahr and Stichler patent, No. 948,-773, for a gas iron, claims 2 and 7 held valid and infringed; Strause Gas Iron Company v. Weil; the Hamilton reissue patent, No. 12,750 (original 619,567), for a face plate for burial caskets, held void in National Casket Company v. Stolts; the Seeley reissue patent, No. 12,757, for an incandescent lamp socket, held valid and infringed and in Bryant Electric Company v. David Killoch Company, and the Smith reissue patent, No. 13,033 (original No. 759,037), for a lamp, held void as not for the same invention disclosed in the original patent; also held not infringed if valid; Smith Incandescent Light Company v. Welsbach Gaslight Company.

Competition for Miners' Lamps

THE use of portable acetylene lamps has become general in a large number of mines, and this illuminant has definitely replaced the old lamps, oil or otherwise, thanks to its cheapness and the excellent light given by it, and the number of acetylene miners' lamps at present in use can be counted by the hundred thousand. Nevertheless, in spite of various models employed, it does not seem that any of them completely realize all the conditions which a good miners' lamp should fulfill; it is, perhaps, on this account that this application of acetylene is not so universal as it might be. The carbide factories have therefore decided that here they had to find a perfect article, and they have just established an International Competition to this effect, of which the following are the conditions:

Under the auspices of the acetylene unions of the different countries, a competition for acetylene lamps for mines not containing fire-damp is opened from now under the care of the International Committee of Carbide of Calcium, at Geneva. The prize or prizes shall be awarded to the lamp or lamps which most completely fulfill the following conditions: Simplicity and regularity; cheapness; strength and lightness; easiness of upkeep; convenience in cleaning and refilling; difficult to upset; easily handled, and capable of being carried in the hand or being hung on the walls; solid material, light, durable, and unaffected by dampness or the results of the decomposition of the carbide; strong burner of long duration and placed or arranged so as to avoid extinction from dripping water or by mine violences; production of gas as constant as possible; rational generation from the point of view of purity of the gas as well as the yield of the carbide; utilization of the present sizes of carbide; intensity of 5-10 candle-power as far as possible; duration of charge as long as possible. The competition shall be divided into two categories: (1) portable lamps for carrying by hand, duration of charge 8 to 12 hours; (2) portable lamps for carrying on the forehead, of extreme lightness and a duration of at least 4 to 5 hours. At the discretion of the jury, either one or two prizes may be awarded, of a total of 5,000 francs, which may be granted, if two prizes are awarded, as to 3,000 francs for the best portable lamps for the hand, and as to 2,000 francs for the best portable lamps for the forehead. The models, with description, price of re-sale, etc., must be forwarded before March 20th, 1913, to the International Committee of Carbide of Calcium, 5 Rue des Granges, Geneva. The jury will be composed of competent delegates from the different countries nominated by the respective acetylene unions.

Prizes for Electric Mine Lamps

THE British Home Office has published the report of the judges in the competition promoted last year by the gift of $5,000 by a colliery proprietor, which had for its object the encouragement of the production of safe and efficient types of electric lamps for mines. The judges, Charles Rhodes, a former president of the Mining Engineers' Institute, and Charles Merz, a member of the recent departmental committee on the use of electricity in mines, had submitted to them one hundred and ninety-five lamps, and have awarded the first prize of $3,000 to the C. E. A. G. lamp, sent in by F. Farrer, Dortmund, Germany. Inasmuch as a number of other lamps possess considerable merits, the amount offered for competition has been divided into the first prize of $3,000 and eight prizes of $250 each. In an early issue we will publish in the Inventor's Department a brief illustrated article on the prize winner's lamp.

Notes for Inventors

Novel Cup or Hole Rim for Gold Links.—This cup or hole rim, patented, No. 1,041,081, to Howard Hinckley of Washington, D. C., has a cup section and a lower anchor section, one of the sections having a threaded stem and the other helically disposed lugs which form a mutilated thread and by adjusting the connection, the cup may be located properly with respect to the anchor section.

A Drinking Bowl for Horses.—Richard Markley of Norristown, Pa., has obtained a patent, No. 1,042,246, for a drinking bowl for animals in which there is a bowl-shaped body portion and a nozzle projecting upwardly within the bowl and shaped to be taken into the mouth by an animal, the nozzle having a passage through which water passes from the supply and the sides of the bowl project above the top of the nozzle.

Two New Edison Patents.—Thomas A. Edison has secured a patent, No. 1,041,756, for a conveyer in which there are upper and lower runs of a belt and means which receive the material discharged from the upper run and direct it forwardly upon the lower run in the direction of travel of the latter at substantially the same speed as that of the belt. Mr. Edison has also secured a patent, No. 1,041,983, for a phonograph stylus, this patent being assigned to Thomas A. Edison, incorporated. The invention in this patent includes a stylus for talking machines which is formed of crystallized boron with a rounded point adapted to travel in the groove of the sound record.

Wanted, a Close-fitting Glass Door Knob.—Crystal door knobs of cut or other glass continue to grow in favor. A correspondent calls attention to an objection to this form of mounting in that the connection of the glass with the metal seems in present forms to involve a greater projection from the surface of the door than the metal or similar commercial knobs, and suggests the possibility of so connecting the glass with the metal as to enable the fitting of the crystal knobs as near to the door surface as others. This may necessitate changing the form of the knob itself as well as the method of connection with the metal, but the thoughtful inventor should have no serious difficulty in producing a knob free of the objections above noted.

Touring Accessories.—Now that automobiles have so advanced that they make extended tours more and more desirable, greater attention will be given to the attachments and equipment in the way of facilities for camping out over night, as well as along the culinary line. One has only to consider the sleeping accommodation of the ordinary gypsy wagon to realize the opportunities of even a small car. It is believed that one could devise a simple form of folding cot adapted to be supported upon the front and rear seat backs. The problem would doubtless be more in the means for anchoring the cots in place than in the folding features for close storage, but, possibly, the inventor may combine the features. For cooking en route, chafing dishes and other forms of alcohol stoves are convenient, and kits with facilities for using gasoline, the fuel at hand, may find favor.

Operates Alarm Circuit from Vault Lining.—John P. Williams and Herman Huhn of New York city, assignors to Electric Bank Protection Company, have patented, No. 1,041,395, an electrothermostatic lining for vaults, safes, etc., in which the spaced thermostatic conducting plates in layer with lining members, operate when subjected to heat, to actuate an alarm, in an alarm circuit which includes the spaced layer plates.

Electricity Utilized in Cotton Harvester.—A San Francisco man, Willie Robert McComb, has patented an improvement in harvesting cotton by which the cotton on the plant is charged with electricity to cause it to expand and a current of electrified air is utilized to remove and harvest the cotton when it has been thus expanded. The patent claims the process and also the harvester in which the process is utilized in the field. The patent is No. 1,041,650.

Muffler for Motor Boat Engines.—Robert Sheldon Strahan of Brooklyn, N. Y., has patented, No. 1,041,190, a muffler for motor boat engines which muffler is in the form of a funnel-shaped chamber attached to the end of the exhaust pipe of the engine with the open end of the chamber to rest slightly below the surface of the water, so that a partial vacuum will be formed in the chamber.

An Elihu Thomson Arc Lamp.—In patent No. 1,041,197 to the General Electric Company, as assignee of Elihu Thomson of Swampscott, Mass., is shown an electric arc lamp in which the lever for operating the arc establishing clutch is actuated by an electro-magnet and means are provided for damping the action of the electro-magnet for reinforcing the bite of the clutch by and in accordance with the action of the electro-magnet.

A New Multi-stage Elastic Fluid Turbine.—The General Electric Company, as assignee of Louis C. Loewenstein of Lynn, Mass., and Leonard H. Dyer of Greenwich, Conn., has secured a patent, No. 1,041,121, for a multi-stage elastic fluid turbine which has a furnace within its shell for reheating elastic fluid between stages, the reheating means being located between the stages and being independent of the generator furnace.

Legal Notes

Assignment Before Issuance of Patent Conveys Only an Equitable Title.—An assignment before the issue of a patent of the entire interest in an invention conveys only an equitable title, and the holder of such an assignment, even though it be duly recorded in the Patent Office, cannot revoke the power of attorney given by the inventor in his application. Following an old decision by Chief Justice Taney, the Patent Office has repeatedly sustained this view, holding in one case that where two instruments are recorded in the Patent Office, both of which purport to assign the invention disclosed in an application and only one contains a request that the patent issue to the assignee, the Patent Office, under the authorities, should recognize only the right to prosecute the case of that assignee to whom it is requested that the patent issue, and this to the exclusion of the other assignee. The practice is founded upon the principle that prior to the issue of the patent the inventor has an imperfect and inchoate right which he may perfect and make absolute by having letters patent issued to him, and an assignment, including a request for the issue of the patent accordingly, passes the legal title to the assignee, because under it the assignee has, as the inventor had by law, the right to secure letters in his own name.

"Tabloid" a Proprietary Trade-mark.—According to the Oxford English Dictionary, edited by Sir James A. H. Murray at the Clarendon Press, Oxford, volume ix, published October 1st, 1910, "tabloid" was registered as a trade-mark on March 14th, 1884, in England by Messrs. Burroughs Wellcome & Co. for chemical substances used in medicine and pharmacy, and afterward for other goods. The Court of Appeal in England held the term to be a "fancy word" as applied to the goods for which it was registered, and accordingly restricted the use of the term to the preparations of the firm named. "Tabloid" is also a valid trade-mark in this country for similar preparations made by the firm.

Trade-mark Notes

Proof of Infringement.—In the case of Gorham Manufacturing Company v. Schmidt et al., the District Court S. D. New York, by Justice Hazel, has held that proof of sales by defendants as dealers of articles bearing infringements of complainants' trade-marks, although to agents of complainants only, together with proof that defendants had other similar articles displayed for sale in their store, is sufficient to entitle complainants to an injunction and that dealers are obliged to be on their guard when buying from manufacturers and to a certain extent are put upon inquiry as to the character of the manufactured product and the manner in which it is labeled or impressed as well as the packages in which it is contained, in order to protect the trade-mark rights of other manufacturers in the same business.

Names of Ex-Presidents not Registrable as Trade-marks.—The present Commissioner of Patents refused some years ago to register the name of ex-President Grover Cleveland as a trade-mark for cigars upon the ground that to use the name of ex-Presidents as trade-marks tends to detract from the high office which they have held and for that reason it was believed to be against public policy for the Patent Office to encourage such use of the names by allowing them to be registered as trade-marks.

Insufficient Use of Trade-mark.—In the trade-mark opposition case of Patterson v. Hay, it appeared that the only use by Hay of the mark for a liquid binding agent for roads, etc., had been upon a small number of gallon cans of the solution which were shipped as samples. Commissioner Moore held that this use was not such that any trade-mark right could be based upon it and sustained the decision of the Examiner of Interferences in favor of the opposition by Patterson to the application for registration filed by Hay.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT FORM.—E. T. PALMENBERG, 710 Broadway, New York, N. Y. This improvement provides a garment form, more especially designed for fitting skirts, petticoats and like garments and arranged to support pins which can be conveniently removed by the operator for use in fitting the garment.

CONVERTIBLE HOOD, CAPE AND VEIL.—MARION JOHNSTONE, 75 S. 5th St., Brooklyn, N. Y. This invention provides a convertible hood, cape and veil arranged to form an attractive and comfortable article for the protection of the head, neck and chest in cold weather, or to form a cape, or an accessory, or a trimming, or a veil over the head or hat, or as a sunbonnet for summer use.

Pertaining to Aviation.

LIFE SAVING GARMENT FOR AVIATORS.—J. J. COSTANZO, care of Mons. C. G. Onistas, Ingénieur, 106 Rue Adel Moneim, Alexandria, Egypt. This invention provides a garment adapted for aviators, to prevent injury or death when he or she is dropped with or from an aerial craft. Use is made of an inflatable casing, preferably made of connected sections of rubber or any other inflatable substance with air-receiving apertures therein and means whereby the shock of a fall or blow will be substantially absorbed by the casing and its parts and not communicated to the aviator within the casing.

Of General Interest.

COMBINED EYEGLASS-CASE AND SCREW-DRIVER.—H. ASHER, 414 E. 187th St., Bronx, N. Y., N. Y. The object here is to provide a combined eyeglass-case and screw-driver, of which the case is adapted to carry eyeglasses in the usual manner, and the driver is mounted on the case to permit convenient removal thereof for repairing the eyeglasses in case of need.

NON-METALLIC BEARING.—C. O. L. CARDELL, Pearl River, N. Y. This invention provides a bearing, pulley, bushing and like articles, formed of wood and so treated that the fibers are hardened, and the wood is permeated with a special lubricant and preserved, to render the article exceedingly serviceable for use in spinning and other machines, especially as constant oiling can be dispensed with.

PIANO HAMMER.—J. W. E. LAKER, Box 103, Victoria, British Columbia, Canada. This invention relates to hammers for pianos and other stringed instruments, and more particularly to the socket or joint connecting the head with the shank of the hammer. An object is to provide a joint or socket, whereby a new head may be readily applied to the shank of the hammer without interfering with the rest of the mechanism.

DEVICE FOR COOKING COTTON SEED OR LINSEED MEATS.—C. H. FULSON, Memphis, Tenn., care of J. W. Todd, New Orleans, La. An object here is to provide a device having a series of retainers, each provided with a movable cover, which may be held in close contact with the charge to be cooked, and which may be moved automatically by the pressure of the charge itself, or manually.

SCREEN BED.—F. B. EASTON, 321 E. 15th St., Manhattan, N. Y., N. Y. This invention has reference to hospital beds and the improvement is provided with means for screening the bed on both sides of the same when the occupant of the bed requires medical attention. The screen is built into the structure of the bed so that it can be called into use at a moment's notice.

MOTOR BOAT.—J. D. MULLER, 126 Marteuse St., Brooklyn, N. Y., N. Y. Certain improvements in this propelling apparatus comprise in effect a series of paddle blades mounted upon an endless chain which carries the paddle blades successively into engagement with the water, to move the boat forward.

FINGER CUFF.—C. C. HEDRICK, care of Swift & Co., Kansas City, Kan. More particularly the invention comprehends a shackle adapted to be secured on any finger on either hand, the device being especially intended to prevent escape. The principal purpose is to provide a finger cuff made up of parts in which

FINGER CUFF.

the finger is positioned, the parts being movable relatively to each other and being adapted to be held in such removed position whereby movement of the finger or straightening thereof is prevented. The engraving herewith shows a perspective view of the device in operative position on the index finger.

LOCK FOR BASCULE BRIDGES.—H. C. KRASE, 1739 Spalding Ave., Chicago, Ill. The main object here is to provide a device in which the strains are taken up by the lock and one which is easily manipulated so as to permit the bridge to open. It provides locking means of great power for forcing the heel of the counterweight tightly against the bumping block so as to prevent any movement of the bridge while in use.

SIPHON VALVE FOR FLUSHING TANKS.—J. J. MEYER, 336 Lenox Ave., New York, N. Y. This invention relates to discharge valves of flushing tanks for water closets, urinals, and other similar features, and the aim is to provide a valve for permitting a full or only a partial discharge of the water in the tank from above the normal level of the water in the tank; to provide means for the escape of overflowing water from the leakage of valve cocks; and to prevent waste of water by leakage or other causes.

Hardware and Tools.

COIN-CONTROLLED LOCK.—D. W. WOOD, care of McNutt & Shattuck, 12 Knight Block, Brazil, Ind. Mr. Wood's invention relates to a coin-controlled lock, and more particularly to locks on doors to rooms, to enter which a charge is made. It provides a lock in which the coin will remain in view after the door is unlocked and will remain in this position until the door is opened from the inside.

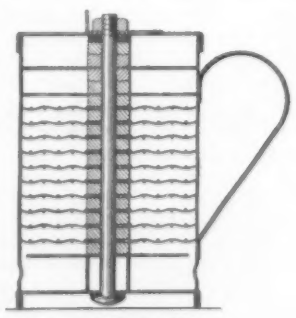
COMBINED SEAT DRESSER AND CUTTER HOLDER.—W. KAISER, 153 So. Main St., Wilkes-Barre, Pa. This tool provides for always having a plurality of cutters with the dressing-tool, which may be readily attached to and detached from the dressing-tool and stored in the receptacle. There is thus no danger of losing the cutters, and the dressing-tool has been so modified as to combine therewith a suitable receptacle which alters its structure, but co-acts therewith to obtain a definite result.

DOOR CHECK.—E. W. CLARK, 617 2d Ave., South, St. Petersburg, Fla. The intention here is to provide a simple and inexpensive construction and arrangement of parts whereby to provide a door check which will be efficient in use and possess strength and durability, and in which the tension may be readily regulated.

SHOE JACK.—F. MELLEN, North St., between Union Place and Wyckoff Ave., Brooklyn Hills, New York, N. Y. This inventor's aim is to compensate for the wear on the sole during the period of wearing the shoe. An object also is to restore the resiliency, elasticity, strength and stiffening to the soles under the instep, and to afford an improved resting place for the ball of the foot.

HOLDER FOR INKWELLS.—C. KRICKE, 111 W. 3d St., Beardstown, Ill. This invention provides means to hold an inkwell now commonly used in school desks, and to so position the well as to bring its top below the surface of the desk top, thereby preventing the spilling and spreading of ink on the top of the desk. An important feature of the invention is the part the holder plays in affording protection to books and papers. In case any ink is spilled or there is a surplus of it, the fluid is retained in the bottom of the holder and cannot pass to the receptacle or drawer below.

INSECT TRAP.—C. HORSTMANN, Oswego, Ore. The principal object here is to provide a trap having a maximum holding capacity, simplicity of construction, and arranged for ease of manipulation. The insects are captured by being drawn by the bait in the trap, to enter through the slots at the bottom of the trap. From the bottom disk they crawl



INSECT TRAP.

successive wire disks. Somewhere in their climb prior to reaching the topmost disk where most of the bait is deposited the insects are overcome and die. The engraving inserted herewith shows a vertical section of the trap.

DOOR CHECK AND HOLDER.—H. A. GUSTAFSSON, care of J. V. Addis, Nausori P. O., Rewa River, Fiji Islands. This improvement is in means for retaining in an open or partially open position, a door, gate, window or other swing closure, and has in view a catch which will operate automatically to engage the door or other closure when the latter is sufficiently thrown open, and hold the same from closing until purposely released.

DOOR OR WINDOW LOCK.—V. J. DANIELS, 101 Walker St., New York, N. Y. This device is for use in securing a window, door or other movable object in any desired position. Such devices are used for locking a door or window shut when the same is not furnished with regular locks, and an object here is to provide a device which may be easily carried in the pocket or suitcase when away from home.

FASTENING DEVICE.—R. V. SAMPSON and S. T. DANLEY, Room 17, 1643 Champa St., Denver, Colo. The invention relates generally to fastening devices and more particularly is directed to a structure which is especially adapted for securing the lines from the bridle bit or halter of a horse in order that the animal may be hitched to a suitable post or other support.

Machines and Mechanical Devices.

APPARATUS FOR MAKING TOOTHED GEARING.—F. HUMPHRIS, Barton Peveril, Eastleigh, England. The present invention relates more particularly to generating apparatus for use in the production of the operative surfaces of the helmet-shaped teeth and correspondently shaped recesses or holes constituting the generated elements in the well-known "Humphris" type of gearing in U. S. Patent No. 859,662, and U. S. pending application Serial No. 467,154.

TOOTHED GEARING.—F. HUMPHRIS, Barton Peveril, Eastleigh, England. This invention relates to apparatus for producing the operative surfaces of the so-called "generated" motion-transmitting elements in gearing wherein the operative surface of a motion transmitting element in one member is produced by the generative action of a rotary cutter having an effective profile which represents the operative surface of the coacting element in the other member of the gearing. It relates more particularly to the apparatus in U. S. Patent No. 859,662 and U. S. pending application Serial No. 467,154.

APPARATUS FOR MAKING CONFETTI.—G. G. GRIFFIN, 65 Wall St., New York, N. Y. This machine makes confetti by cutting up a sheet of paper or cardboards having perforations therethrough arranged in rows. The perforations may have various shapes, and when the paper is cut up, it is divided along lines joining the centers of the perforations of each row in one direction and other lines at angles thereto.

ASSEMBLING MACHINE.—GEORGE A. ENSIGN, care of Defiance Machine Works, Defiance, Ohio. This assembling machine is more especially designed for assembling the sections of wooden wheels such as are used for automobiles and other vehicles, the machine being arranged to insure an accurate and quick assembling of the wheel parts with a view to form a true wheel and to provide the wheel parts with a false or a temporary hub to hold the parts together until a tire is placed on the rim.

SCRAPER ATTACHMENT.—G. E. TUCKER, Springwater, N. Y. The invention relates to road grading machines, and particularly to attachments for scrapers and an object is to provide a structure which will permit the scraper to readily pass over obstructions without injury to the machine or the scraper.

CUT OFF FOR BOX COVERING MACHINES.—A. BELL, 103 Beach St., Jersey City, N. J. The improvement is in cut offs for box covering machines or the like, and the purpose is to provide a structure whereby the cutting knife will automatically disengage itself and when worn may be adjusted for presenting a substantially even cutting surface.

REDUCING VALVE.—S. A. STINSON, 751 Amsterdam Ave., New York, N. Y. The more particular purpose of this inventor is to provide a valve having a great variety of uses and being of simple structure and also being capable of handling the flow of liquids in large quantities as well as in high, low or varying pressure.

AUTOMATIC WATER LIFT.—G. A. FERGUSON and A. MARSHALL, Condon, Ore. The invention pertains generally to devices for lifting water and more particularly it involves means whereby a vacuum may be obtained in any suitable vessel communicating with a well or cistern whereby atmospheric pressure may force water from the well or cistern into a vessel.

LINE CARRIER.—L. D. SHAFFER, Scalp Level, Pa. This invention is an improvement in line carriers, such as shown in Mr. Shaffer's prior patent, and like the construction shown in said prior patent, is especially intended for use in stringing wires after the first wire has been strung, as well as for carrying the wires, lines, etc., across an intervening space having a wire for supporting the device.

Prime Movers and Their Accessories.

FLOW MOTOR.—O. C. MOORE, Morrow, Ohio. This device supplies fuel to a steam generator in proportion to the water supplied to said generator, and is what is commonly known as a flow motor; and is adapted for use in connection with the invention disclosed in Mr. Moore's application for a feed water and fuel control.

INTERNAL COMBUSTION ENGINE.—A. F. CHUBBUCK, 264 8th Ave., Grand Rapids, Mich. This engine has a pair of oppositely directed arms secured to a common shaft in a cylinder with means for exploding charges in an arm on one side and an abutment head and the arm on the other side, and a second head whereby the joint effect of the simultaneous explosions causes an oscillating movement of the two arms, thereby doubling engine efficiency.

Railways and Their Accessories.

SLIDING DOOR LOCK.—H. V. COOKINGHAM, Rensselaer, and G. O. PRICE, 521 First St., Albany, N. Y. For the purpose of this invention use is made of a track on the side of the car, hangers fastened to the car door and provided with hooks engaging the track, rollers journaled on the hangers and mounted to travel on the track, and manually controlled wedges adapted to be forced between the rollers and the track to firmly engage the hanger hooks with the track and thus lock the door in open, closed or partly open position.

RAILWAY ROAD BED.—J. O'GORMAN, San Luis Obispo, care of A. L. Dutton, 76 Higuera St., Obispo, Cal. This inventor has devised an improved construction of block and provided the same with metallic chairs adapted to receive and support rails, and has also connected the opposite blocks by means of adjustable metallic ties.

RAILWAY SWITCHING APPARATUS.—G. CAMPANA, Manhattan, N. Y., N. Y. This apparatus is for use on railways of all kinds, and is adapted to obtain results without stopping the car or train in order to throw the switch, or even to slow down when the switch is approached, and it is not necessary to have a switchman or other track attendant on duty at the switch at the instant the car or train is passing.

RAIL BRACE.—A. R. DAVIS, 8 Cemetery St., Oneida, N. Y. This improvement has reference generally to rail braces and more particularly is directed to a construction adapted to extend between and engage both rails of a track whereby the spreading of the same, due to lateral pressure, may be prevented.

Pertaining to Vehicles.

METALLIC WHEEL.—S. H. SUMMERSCALES, Box 1891, Winnipeg, Manitoba, Canada. This invention consists primarily of a metallic wheel having flat spokes attached to the sides of a channeled hub, and channeled tire. Between the two sets of spokes reinforcing means is provided, in order to set forth a wheel of great strength which calls for a small amount of material.

SHOCK ABSORBER FOR ROAD VEHICLES.—A. W. CHAPMAN, 27 Westfield road, Acock's Green, Birmingham, England. This absorber consists mainly of a volute spring, over whose bottom convolution is slipped a plate by which the spring is secured in position with means to effectively grip the splayed-out position of the spring without the latter projecting beyond the lower face of the plate. Into the spring's upper convolution a head of wood, rubber, metal or fiber is inserted. Means are provided which expand the slit portion of the head and by its expansion tightly against the inner side of the upper convolution causes the head to be firmly secured in position.

Designs.

DESIGN FOR A HANDLE.—T. F. CURLEY, 318 Broadway, N. Y., N. Y. This ornamental design is of a stropping handle for any make of safety razor blade. The concave place or thumb seat and the back of the handle are made so as to get the right angle to strop a blade correctly.

DESIGN FOR A BANNER.—A. B. VAN RIPER, care of Frost & Van Riper, Paterson, N. J. This ornamental design for a banner is V-shaped, the main and interior portion being solid black on which in white appears Wilson mottoes and a picture of the "White House." A white border contains repetitions of a shell and oarsman with the words "Wood Row" over each.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12699) P. N. R. asks for information concerning artificial whalebone. A. 1. This material is easiest made from raw animal skins. These are first treated with sulphide of sodium and the hair removed. The skin thus prepared is placed for 24 to 36 hours in a weak solution of bichromate of potash. To dry the skin thus prepared, it can be stretched or tacked on a frame, a flat plate, or any similar contrivance, so that in drying the skin cannot shrink, and to insure its drying as flat as possible. On these frames the skin, exposed to the effect of daylight, is dried, at first slowly, and then exposed to a temperature of 122 to 140 deg. Fahr. The action of the daylight, in combination with the bichromate of potash the skin now contains, makes the glue present in the skin cells insoluble in water, and prevents the occurrence of putrefaction, while the vigorous drying removes the moisture from the innermost core of the leather. The dried skin is then compressed under very heavy pressure, and the material thus obtained possesses a hardness and elasticity closely approaching that of the genuine whalebone. This material, before or after drying, can, by coating, or immersion in a bath of color, be colored as desired in order to impart to it the color of the natural whalebone. It is made better capable of resisting moisture by coating or impregnation with rubber, varnish, lacquer, or similar substances. Where rubber is used, it can be either applied directly or in the form of a casing or covering, drawn over each piece or rod. The separate rods may also be protected from moisture by inclosure in waterproof paper or waterproof fabric. This artificial whalebone can also be made from more or less tanned leather, which, for this purpose, is treated like the untanned skin. When the artificial whalebone is completed it is cut into plates of any desired length and width. The product may also be given a rounded form by pressing. 2. Ordinary rattan is freed from its smooth, glazed exterior covering in a special machine, and by means of a decoction of Campeachy wood and an iron stain, dyed black. When dry it is saturated with a solution of caoutchouc, gutta percha and sulphur in coal-tar oil. After this the rods are steamed in a steaming apparatus under a pressure of two atmospheres, whereby the mixture with which the cane is impregnated is thoroughly hardened (vulcanized), and finally they are passed between rollers whereby they are made absolutely dense and highly elastic. 3. Caoutchouc, 1 part; shellac, 0.2 part; magnesia, 0.2 part; sulphur, 0.25 part; golden sulphur, 1.25 parts. The caoutchouc (India rubber) must be cut up very fine and then kneaded in with the other ingredients at a steadily rising temperature, which, however, must not be allowed to rise above 284 deg. Fahr. Rattan, split into fine strips, is treated in the hot mixture for several hours. 4. Cane strips, saturated with a solution of nitrate of iron, Campeachy wood and vitriol, treated with linseed oil varnish, and finally polished. 5. Suitable fibers, such as piassara, alfa, Mexican fiber, etc., are saturated with a solution of silicate of soda, either alone, or mixed with baryta, felspar or chalk, or with any glue, cement, gum, etc. The mass is cut into strips and dried. Hereupon it is covered with a coating that dries in the air, such as glue, shellac, celluloid, etc., also with caoutchouc solution, copal, etc.; finally it is wound spirally with a covering of silk, etc. For brushes or brooms, the thin, short fibers are used, saturated with arosin solution.

(12700) G. W. asks for formulas for embalming fluids. A. The following is a formula for the embalming fluid approved by a committee of the National Funeral Directors' Association of the United States: Solution of formaldehyde, 11 pounds; glycerine, 4 pounds; sodium borate, 2½ pounds; boric acid, 1 pound; potassium nitrate, 2½ pounds; solution of eosin, 1 per cent, 1 ounce; water, enough to make 10 gallons. The sodium borate, boric acid and potassium nitrate are dissolved in 6 gallons of water; the glycerine is added, then the solution of formaldehyde, and lastly the solution of eosin, and the necessary amount of water.

Morell's Antiseptic Liquid.—Arsenious acid, 14 ounces; caustic soda, 7 ounces; water, 20 ounces; carbolic acid, sufficient to render the fluid, after stirring, opalescent; then add water enough to make 100 ounces. Mix well.

Modern Formulas. 1. Salicylic acid, 4 drachms; boric acid, 5 drachms; potassium carbonate, 1 drachm; oil of cinnamon, 4 drachms; oil of cloves, 3 drachms; glycerine, 5 ounces; alcohol, 12 ounces; hot water, 12 ounces. Dissolve the first three ingredients in the water and glycerine, the oils in the alcohol, and mix the solutions. 2. Thymol, 15 grammes; alcohol, ¼ ounce; glycerine, 10 ounces; water 5 ounces. 3. Potassium nitrate, 40 grammes; potassium carbonate, 40 grammes; glycerine, 1,000 cubic centimeters. Success in the use of any embalming fluid depends largely on manipulation, an important part of the process being the thorough removal of fluid from the circulatory system before undertaking the injection of the embalming fluid.

NEW BOOKS, ETC.

HISTORY OF BRIDGE ENGINEERING. By Henry Grattan Tyrrell, C.E. Chicago: Published by the author, 1911. 8vo.; 479 pp.; illustrated. Price, $4.

ARTISTIC BRIDGE DESIGN. A Systematic Treatise on the Design of Modern Bridges According to Æsthetic Principles. By Henry Grattan Tyrrell, C.E. Chicago: The Myron C. Clark Publishing Company, 1912. 8vo.; 300 pp.; 150 illustrations. Price, $3.

The author calls attention to the fact that the history of bridge engineering is generally slighted in the schools, partly from a failure to realize its practical importance, partly from lack of works on the subject. In approaching problems in any art or science, incalculable time and effort may often be saved by a knowledge of what has been done in the past. This history condenses the experience of ages into a text-book of moderate size. Out of some two thousand pictures and designs, 330 were finally chosen to illustrate the work. From the bridges of Egypt and of Rome, through the constructions of the mediæval and renaissance periods, the author leads us to the discussion of modern stone bridges, pontoons, aqueducts, bridges of wood, cast iron, solid and reinforced concrete, with chapters devoted especially to suspension and cantilever bridges. In "Artistic Bridge Design," Mr. Tyrrell urges greater attention to the artistic treatment of bridges, and endeavors to supply the essential knowledge and the primary training necessary to develop taste and judgment. His examples are well selected, his arguments well presented. The many fine illustrations of American bridges show that it is the utilitarian principle carried to extremes, and not any lack of talent in our native bridge architects, that is responsible for the numerous grim, repellent skeletons that straddle our busy waters.

DER PANAMAKANAL. Die Bedeutung des Kanalbaues Seine Technik und Wirtschaft. Von Dipl. Ing. Max D. Fiegel. Mit 16 Abbildungen im Text und einer Übersichtskarte. Dietrich Reimer (Ernst Vohsen) in Berlin.

This book on the Panama canal has been written ostensibly for the purpose of placing before the German exporter a clear account of the construction of the Panama canal and of the business significance of a waterway which will have a tremendous bearing upon his export trade. The author writes of the Panama canal evidently from personal inspection and knowledge. He discusses first the Panama situation up to 1901, and then proceeds to describe the character of the country through which the canal passes, the merits of a sea level or lock canal, the manner in which the canal is being built, transportation facilities of the Isthmus, the various dredges and other machines used for wet excavation, and the operation of the canal when it is finished. So much for the section on the mechanical construction of the canal. The commercial section of the book deals with the administration of the Canal Zone by the United States, as well as the industrial, political, and military significance of an Isthmian waterway. On the whole, this may be regarded as the best popular book that has appeared in Europe on the subject of the Panama canal.

THE GREAT STAR MAP. Being a Brief General Account of the International Project Known as the Astrographic Chart. By H. H. Turner, D.Sc., D.C.L., F.R.S. 159 pp. New York: E. P. Dutton & Co., 1912.

In this little book Prof. Turner has given us what may well be considered a model of popular astronomical writing. He has told plainly and simply the nature and the importance of the huge photographic catalogue which is now being published in different ways by different observatories. The subject offers no chance for startling writing, no chance for playing upon the reader's dramatic sense; yet Prof. Turner has produced a wonderfully interesting volume that will be read with pleasure and profit by the amateur astronomer in particular.

THE BOY'S PLAYBOOK OF SCIENCE. By John Henry Pepper. Revised by John Mastin, M.A., D.Sc., Ph.D. New York: E. P. Dutton & Co., 1912. 8vo.; 680 pp.; illustrated. Price, $2.50 net.

Years ago, when our old boys were young, the popularized science of John Henry Pepper furnished them with many an hour of recreation and instruction. Now one of his books, "The Boy's Playbook of Science," comes to us with a fanfare of trumpets as "revised, rewritten, and reillustrated, with many additions." A perusal of the reviser's preface leads one to expect great things, but on close examination it is found that the new edition is nothing short of an imposition upon an unsuspecting public. There are a few pictures of aeroplanes and a page or two of futile description; two pages of drawings of the modern locomotive; brief mention of radio-activity and wireless telegraphy; and some poor illustrations of the turbine. These seem to be all the additions worth noticing. The preface epitomizes the faults of the volume. It consists of unfulfilled promise, perfervid exhortation to the youth of England, and a rather ludicrous and bewildering comparison of a rope-dancing monkey with the boy and his "God-like attributes." Throughout, the work is couched in that ponderous, uninteresting language affected by pedants of the old school. The saddest parts are those where the shadow of some humorous reference has fallen across the mind of the writer without focusing itself clearly, and the result is that saddest of all sad things, a joke that is not a joke. However, we must do the book the justice of saying that it avoids for the most part even the suspicion of jocularity, taking itself with a labored seriousness. A great many old and obsolete pictures encumber the work without adding to its value. As a case in point may be cited the steam gun, to which space has been devoted wholly incommensurate with any lesson it may now have to impart. In short, it is inconceivable that the new edition should appeal with any degree of success to the American boy, who has at his command timely works in simple and absorbing language, yet even more authoritative and instructive. The whole tone and tenor of the volume is that of an outlived past, with all the faults of antiquity and little of its charm. The boy of to-day has been educated to expect something entirely different, and he is entitled to get it.

THE BUSINESS OF MINING. A Brief Non-technical Exposition of the Principles Involved in the Profitable Operation of Mines. By Arthur J. Hoskin, M. E., Consulting and General Mining Engineer. With 16 full-page illustrations and 1 chart. Philadelphia: The J. B. Lippincott Company, 1912.

Probably no form of stock-jobbing has been so debased as that of selling mining securities. The result has been that deposits which might be worked with great profit if the necessary funds were only forthcoming, must occasionally be held for years, until a favorable opportunity presents itself for the formation of a company by honest men. Obviously a book is needed which will give the investor an insight into mining, and which will show what forms of mining may be followed as a business, with just as much assurance of success as that which attaches to any one of the many lines of industrial activity. This purpose Mr. Hoskin has admirably fulfilled in writing the volume that lies before us. Nothing of a technical or engineering sort has been attempted, his sole aim being to establish the reliability and the credit of the mining industry, as a whole by pointing out the lines of conduct which should be followed by those who enter its precincts as business people.

ELEMENTARY ENTOMOLOGY. By E. Dwight Sanderson, Dean of the College of Agriculture, West Virginia University, and C. F. Jackson, Professor of Zoology in New Hampshire College. New York: Ginn & Co., 1912. Price, $3.

In their preface the authors assure us that this book is the result of an effort to furnish a text-book for beginners. The economic side of the subject has been made the dominant note in the book and the forms discussed are mostly those of economic importance. Believing that the subject matter of a course in entomology should be not a discussion of the common injurious insects, as commonly supposed, but rather a knowledge of the structure, habits, and classes of insects in general, the authors have given us a book in which the more important phase of entomology for academic study is presented.

A HANDBOOK OF TESTING MATERIALS. By C. A. M. Smith, M.Sc. New York: D. Van Nostrand Company, 1911. 8vo.; 284 pp.; illustrated. Price, $2.50 net.

Written primarily for the student, this work may be read with benefit by the working engineer. It discusses the general properties of materials, illustrates and describes the machines used in tension, compression, and bending tests, explains strain-measuring instruments and their use, and summarizes methods and results. It deals also with the testing of cements, reinforced concrete, stone, and timber, and presents experiments suitable for the college laboratory. Appendices include recent researches that will be of interest to the advanced student. In addition there are tables of useful constants and a bibliography. The plates constitute a valuable aid to an intimate grasp of the subject.

BROMIDE PRINTING AND ENLARGING. New York: Tennant & Ward, 1912.

DEVELOPERS AND DEVELOPMENT. New York: Tennant & Ward, 1912. 12mo.; paper covers. Price each, 25 cents.

"Bromide Printing and Enlarging" takes up the choice of bromide paper, the question of light and illumination, paper negatives, enlarging both by daylight and by artificial light, and the reduction and toning of bromide prints and enlargements. "Developers and Development" discusses negative making, developing agents, and chemical manipulation. The best-known developers are analyzed and their distinguishing characters made known, with instructions for their most advantageous use in negative making.

FORECASTING WEATHER. By W. N. Shaw, F.R.S., Sc.D. New York: D. Van Nostrand Company, 1911. 8vo.; 380 pp.; illustrated with maps, charts and diagrams. Price, $3.50 net.

In a most interesting introduction, Dr. Shaw tells us how he came to watch the routine of forecasting from the point of view of experimental physics; and in this work he brings "the physical laboratory and the daily weather into harmony." Dr. Shaw is confronted at the outset of his work by great difficulties due to double standards of measurement—the metric and the popular. He seems to have done the best possible thing under the circumstances, and his preliminary chapter on units clears the way to intelligent discussion. As to plan, the work first explains and illustrates the construction of the synoptic chart, and its use in forecasting. The physical processes involved in weather phenomena are given a careful examination. Subsequent chapters present special phases of the work of forecasting—gales and storm-warnings, anticyclonic weather, land and sea fogs, and forecasts for aeronauts. Recent developments in practice, as put forth by such authorities as Ekholm and Guilbert, receive due attention, and there is a chapter on statistical methods for long-period and seasonal forecasts.

THE UNITED STATES PATENT OFFICE. By E. C. Moore, Commissioner of the United States Patent Office. Reprinted from Vol. IV, 1911, of the transactions of the American Institute of Chemical Engineers.

Although this paper was intended primarily for chemical engineers, it contains matter, that should be of interest to every inventor, manufacturer, and scientific man who comes into contact with the Patent Office directly or indirectly. Commissioner Moore, has here succinctly pointed out the needs of the Patent Office, and made a strong plea for the use of the millions already collected from inventors for the improvement of the patent service.

ANTHROPOLOGY. By R. R. Marett, M.A. New York: Henry Holt & Co., 1912. 16mo.; 256 pp. Price, 50 cents net; by mail, 56 cents.

Prof. Marett's definition of anthropology is "the whole history of man as fired and pervaded by the idea of evolution." The race problem as stated, the influence of environment traced, language and its development forms a pleasing chapter, and essays on social organization, law, religion, and morality lead up to as epilogistic study of man as an individual. The book is from the new "Home University Library of Modern Knowledge."

JANE'S FIGHTING SHIPS. 1912. Fifteenth Year of Issue. Published and edited by Fred T. Jane. With a Special Chapter on the "Progress of Marine Engineering," by Charles D. Sells, Member of the Institute of C. E. Sampson, London: Lowe, Marston & Co., Ltd.

Jane's "Fighting Ships" is familiar to everyone who is interested in naval matters the world over. During its fifteen years of issue this work has grown by steady increment, and the volume before us is a veritable compendium of naval information closely compacted within 550 pages. The book is undoubtedly the most exhaustive compendium of naval information of its kind, and it is just that kind of information that practical naval men and laymen who take a technical as well as a general interest in naval affairs are looking for. Every navy in the world is described. The work includes for each navy a series of silhouettes of every important ship; maps of the leading harbors and naval stations; an outboard profile and deck plans of every important warship in which the guns and armor, their dimensions, calibers, thickness, etc., are shown; a half-tone of every important ship. Full details as to horse-power, speed, trial speed at sea, the character of the machinery, the name of the builders, etc., are given for each ship. Also, for each navy there is given a table of the guns, with weight of powder charge, shell, gun, etc., and the penetrating power. Of great value is the article by C. DeG. Sells on the "Progress of Warship Engineering," in which the very latest developments are illustrated and clearly explained. Also naval enthusiasts will be greatly interested in an article on the "Battleship of the Future," by Gen. Cuniberti, chief constructor of the Italian navy, who, it is claimed, was the first to draw up plans for an all-big-gun battleship.

INDEX OF MINING ENGINEERING LITERATURE. By Walter R. Crane, Ph.D. New York: John Wiley & Sons, 1912. 8vo.; 445 pp. Price, $4 net.

This issue of the index covers the same ground as the first volume, with the addition of a number of new publications. It is especially commendable for its system of cross-references and multiple references, and for its wealth of material on the subject of cost, which covers almost every phase of mining and metallurgical practice. These desirable features will be appreciated by the practicing engineer. The facility with which the list may be consulted, and the ease with which authorities may be found, cannot fail to appeal to the consulting reader, while the publications referred to are for the most part journals, reports of societies, and magazines, which may be obtained quickly and at small expense.

STRENGTH OF MATERIALS. A Text-book for Secondary Technical Schools. By Mansfield Merriman. New York: John Wiley & Sons, 1912. 12mo.; 169 pp.; illustrated. Price, $1 net.

Students in the higher classes of manual training schools have been kept particularly in mind in the preparation of this work, and the lessons are so presented as to dispense with the calculus, and to require only a knowledge of arithmetic, algebra, geometry, and elementary mechanics. Rules are given for the study and the designing of common beams by simple algebraic and geometric methods. The fifth edition added a chapter on reinforced concrete, while this, the sixth edition, presents a new chapter on combined stresses and introduces many new problems.

CANADA. By A. G. Bradley. New York: Henry Holt & Co., 1912. 16mo.; 256 pp. Price, 50 cents net; by mail, 56 cents.

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The Mining of Herculaneum

(*Concluded from page 421.*)

who continued, no doubt, to make the villa at Herculaneum their summer home. They nursed literary ambitions. Their ancestor, Lucius Calpurnius Piso Cæsoninus, seems to have been no better or worse than the average grafting Roman governor *in partibus*. One conceives him as a mild rival of the notorious Verres, who left no marvel of art in all Sicily unlooted while governor of that island, according to Cicero's account of him. It is charitable to suppose that Piso was satisfied to purchase the art treasures and the collection of manuscripts which he conveyed to his Herculanean villa, on the way home from his foreign service, probably at Athens. Several of his bronzes have Greek inscriptions on them, and one of them, which is a copy of the famous Spearman of Polykleitos by a late Athenian statuary, bears the latter's Greek signature, *Apollonios, the son of Archias*. Only two per cent of the 800 manuscripts discovered in the Villa of the Pisones are Latin, all the others are Greek. It is from these that the antique mansion takes its best name, *The Villa of the Papyrus Rolls*.

The Pisones, if indeed they owned this private gallery of sculpture, and library, possessed many fine portraits of Greek literary and other heroes, both in marble and bronze. There is a marble one of the tragic poet Euripides. The Pisones were playwrights themselves. Alexander the Great on horseback, and again, perhaps, on foot, is the subject of two exquisite bronze portrait statuettes. The Pisos had two bronze busts of Demosthenes. The inscribed one has served to identify all the extant portraits of that eloquent patriot, from the famous Vatican statue down. It adorned the library of the Herculanean house, together with several other inscribed bustlets of the leading Epicurean philosophers. Another portrait, of great energy, was named Piso by Comparetti. Others called it Seneca. It is the head, most likely, of some late Greek poet. Still another bronze, which was formerly called Plato, is evidently a bearded Bacchus.

The decipherment of the charred papyrus rolls themselves has revealed the predilection of their first purchaser for the doctrines and writings of one philosophical sect, the Epicurean. To tell the plain truth, Piso's library is a horrible disappointment. Instead of lining his pigeonholes with great literature, on the pattern of President Eliot's five-foot shelf, this retired statesman read contemporary philosophy. His favorite authors might have been half a hundred lost Greek poets. They prove to have been the sort of people we used to call divines! The resurrection of Lord Byron's theological bookshelf in the year 2500 would scarcely provoke many shouts of joy. Witness the lines he wrote himself:

"Much English I cannot pretend to speak,
Learning that language chiefly from its preachers.
Barrow, South, Tillotson, whom every week
I study, also Blair, the highest reachers
Of eloquence in poetry or prose.
I hate your poets, so read none of those."[1]

Still, there are fragments of a speech by Hypereides, the man who procured the beautiful Phryne's acquittal by unveiling her charms to an Athenian jury, and an essay by Epicurus, and a readable treatise on music by a certain Philodemos.

The labor and the risk of opening these fragile rolls is incredible. I saw a trained reader undo one under glass at Naples. Two silk ribbons held a film of collodion in process of formation. Sections of the charred writing were persuaded to adhere to this light foundation, as a clockwork slowly, slowly unwound the moistened volume. The reader must copy the surviving syllables as best he can, from his black on black model.

The decipherment and the publication of the Herculanean texts, of the *Volumina Herculanensia*, which were issued under the imprint of the Herculanean Academy by Neapolitan scholars of the eighteenth and early nineteenth centuries, engaged

[1] Byron's "Don Juan," canto II.

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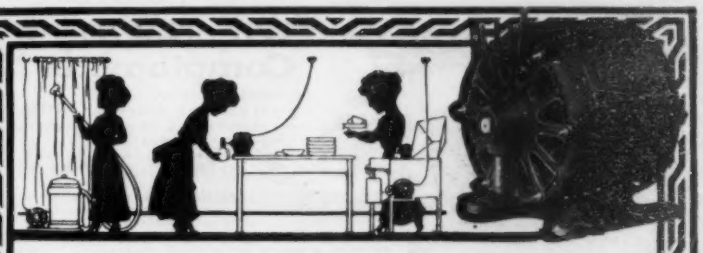
more attention than the exploration of the ruins did, especially after King Charles exchanged the crown of Naples for that of Spain in 1759—the rock was so hard and slow to cut. Moreover, Pompeii was Herculaneum's triumphant competitor from 1748 on, when it also was discovered and identified. The Bonaparte kings of Naples, Joseph and Joachim, did much for Pompeii. Not so the Bourbon rulers, who at one time employed only "fifteen asses and fifteen children" on the ruins, when they had no royal visitor to impress. Herculaneum relapsed into a second semi-oblivion, from which it was dubiously rescued by Victor Emmanuel the Second's assignment of two thousand dollars a year to the new *scavi d'Ercolano* from his privy purse. In Campania, three thousand dollars clears about one buried dwelling house a year. But none of the lately explored buildings has rivaled the basilica of the Balbi and the great theater, or even the Villa of the Pisones. They have not located even the principal street of the old city. It is only fair to add that the mode of clearage and conservation which Fiorelli, the great reformer of the Pompeian enterprise in the seventies, introduced at Herculaneum also, is infinitely superior to the wild rummaging of the d'Elbeufs and Alcubiers. The "new ruins" are partly exposed and partly tunneled shafts.

Some day, perhaps, when curiosity ceases to lash modern explorers to dig more than they can properly digest and preserve, there will be a second resurrection and transfiguration of underground Herculaneum and of its hyperthral sister town. Of one amphitheater and three theaters already recovered, one structure, surely, could be put in condition for entertaining pageants. The house of the Roman consul could be presentably renovated with Sabatino de Angelis's excellent *fac-similes* of its own bronze statues and graceful candelabra, plus duplicates of its transported fresco paintings and mosaic floors.

The decorative significance and the artistic charm of these things was certainly far greater *in situ* than it is in the Naples Museum. And the tourist who cheerfully pays his half dollar at the gate turnstiles, is no irredeemable barbarian if he craves more Cicero and less Dante than he gets now, at the end of his melancholy pilgrimage to the Gulf cities.

Pompeii, in its weatherbeaten bareness, resembles nothing so much as the path of an unrecent conflagration. To visit Herculaneum is to visit a mine. A blotch of bright sunlight still flecks the serried seats of its Greek theater through Prince d'Elbeuf's historic hole. The bronze horses were found on that piece of masonry. These sixteen descending and concave benches were part of the cavea, for which the flower of the local population held ivory tickets on show days. Still farther down, you cross five concentric ledges of more accentuated concavity. Upon these the magistrates and the priestly colleges, the bullet-headed duumviri and portly decuriones, the sleek augustales and purse-proud knights, Roman knights, jostled their cushioned chairs, if the play chanced to be a Greek tragedy. For in that case the chorus sang and performed its evolutions in the orchestra. When the play was a comedy or a masque or a burlesque, there were orchestra chairs. But the highbrows of the period rarely got their favorite Ibsens. The play was more often a medley of music and morals, of *pas de deux* and mass alignments interspersed with sentimental dialogue, such as we too have acquired a faculty of enduring. "The Pleasures of the Enchanted Island." What think you of that? *Très* Louis Quatorze, is it not? Often, too, the people demanded an inexpensive but ridiculous farce of Harlequin and Pantaloon, learned doctor and greedy Brighella; for this is the Oscan country where that form of farce had its birth and is popular still. What flea bites have we not weathered to learn it, from Naples to Calabria!

This supposed platform, which looks like a series of holes in a tunnel floor, was the stage, so the guide says, and we marvel faithfully when he shows us how wide it



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was by going to the other end of it with his shrinking torchflame. It is one third wider across than La Scala's stage at Milan is, and was backed with a niched and statued wall representing a conventional palace front, as the surveys of La Vega and the plastic model in the Resina Museum show. For little is visible of all this. The back wall was often, also, hung with painted drop scenes, and was flanked with painted side scenery mounted on triangular prisms that were easy to switch for changes. And over the open top of the house, sailors doubtless stretched great embroidered awnings to shade the spectators, as we know they did at Rome and Pompeii.

Two ivory play tickets have been found in the buried playhouses. One of them specifies seat or tier 12 in the Æschylus section. Campania evidently followed the example of Athens, where statues of the classic dramatists adorned the scene of their triumphs, and gave names to sections of the theater. One likes to think that Roman theaters encouraged many minor social pleasures besides gratifying literary taste. I doubt not that many a Herculanean lover tested the precepts of Ovid's frivolous "Art of Love" on the stone benches we are now treading. You must contrive to meet your sweetheart at the circus, says the good poet. None comes between you there. Does her cloak slip to the floor? You must dive for it. Does the dust settle on her dress? You hasten to dust it off. If none settles, you dust that. Presently she will allow you to fan her, and to dilate on the events in progress.

It is time we ceased to eavesdrop upon Ovid's Roman lovers. The uniformed guide shows us out again. It is up, up, over one hundred stone steps from orchestra pavement to the fresh night air on the streets of Portici; for it has fallen dark while we were below. It is too late now to visit the park of the royal villa La Favorita, so we drive three miles on the rattling lava pavement flags of Resina and Torre del Greco to our quarters at the Hotel du Vésuve. No time to dress. A hasty brush-down and a change of neckwear must serve. Alas for America's disgrace! They have dressed the dining room in the national colors and verdure for our special humiliation, and in honor, apparently, of Director Giuseppe Spinazzola's recent promotion to the archinspectorship of antiquities and excavations throughout southern Italy. Dr. Spinazzola, who is here from Paestum, is provokingly modest and reticent. What more has he found there? A new Greek temple, or an army of statues? "There is still better news; but you must wait for the champagne." The explorer's eyes confirm his extravagant promise with a merry twinkle.

At last the butler launches a battery of Asti spumante *grande marque* on the house, and the glad secret is betrayed. Parliament has voted one million francs for the exploration of Ercolano (applause). The King of Italy has been pleased to sign this appropriation, and to grant a further allowance of one hundred thousand dollars for the same service, from his personal resources. This credit is good for three years of operations on an imposing scale. Herculaneum will live again. It is pleasant to be reminded, by an Italian voice, that it was conceived, matured and brought to the present promise of splendid fruition by the admirable courage, skill and dogged perseverance of one American scholar, Dr. Charles Waldstein.

Night Storm Signals

A SPECIAL commission of the International Meteorological Committee, which met in London in June, 1909, proposed a set of storm signals for use throughout the world. This comprised combinations of cone-shaped symbols for use by day, and of red and white lanterns for use by night. The daytime portion of the code was accepted at the last meeting of the International Committee, held at Berlin in 1910, but has not yet been put in operation in all countries (e. g., the United States Weather Bureau still uses flag signals). The proposed system of night sig-

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nals, however, aroused many objections. It consisted of the following combinations of lights, in a vertical line: Two red, for a gale commencing with the wind in the northwest quadrant; two white, for a gale commencing with wind in the southwest quadrant; red above white, for a gale commencing with wind in the northeast quadrant; white above red, for a gale commencing with wind in the southeast quadrant; three lanterns, red-white-red, for a hurricane.

The meteorological service of France urged that these simple combinations would be liable to confusion with other harbor lights, and advocated a set of three-lantern combinations, in a vertical row. The German service favored a triangular arrangement of lights. Various other schemes were suggested. An enlarged commission on maritime weather signals met in London in September, 1912, and after prolonged discussion decided that it would be impracticable to secure universal agreement on a single code of night signals, but that the meteorological services of the world—with whom final decision in the matter rests—could probably be induced to agree that any combination of lamps forming a storm signal shall have the same significance in whatever country it is used. As a majority of the great maritime countries of the world were represented at the London meeting, the ultimate effect of this conclusion may probably be forecast thus: All countries will use vertical combinations of red and white lanterns to warn mariners by night of the imminence of storms and indicate the direction of the wind therein. (The proposal to display lights in a triangular arrangement has been abandoned.) Countries will have the choice of two codes. One of these will consist of combinations of two lanterns; viz., the code described above, as proposed at the meeting of 1909, except that the hurricane signal will be abandoned, and in its place a single red light will be used to indicate an atmospheric disturbance, without information as to the direction of the wind. The other will consist of combinations of three lanterns, and will include a hurricane signal. Lastly, a country may elect to use but a single lantern for night signals; viz., a red light replacing all the day signals.

A further suggestion under consideration is to use a green flag or a green lamp to indicate that no warning can be hoisted on account of telegraphic communication being interrupted, as is now done at Thorshavn, Faroe Islands.

Do Crystals Conduct Heat?

PROF. R. W. CLARK of the Mineralogical Laboratory, University of Michigan, has for several years been experimenting to determine the conductivity of heat in crystals. The apparatus used in the tests consists of a stage for supporting the crystal, so arranged that a spring presses it up against the contact point of the conducting instrument. This instrument is placed at right angles, and may be heated by a flame. The unsatisfactory results were due to the radiation of the heat. To overcome this, a plate of some mineral, such as gypsum, is dipped in paraffine until a thin even coat is formed on one side. The plate is then placed on the stage of the instrument with the waxed surface down. Strips of asbestos insulate the under edges. The point of the conducting wire rests in a depression in the upper unwaxed surface. In this way when the heat is conducted along the wire to the crystal, it must actually be transmitted through the crystal of gypsum before it can melt the paraffine. A very sharply defined ellipse will be noted in the paraffine, and this is clearly due to differences in conductivity of the crystals in different directions and not to radiations from the wire.

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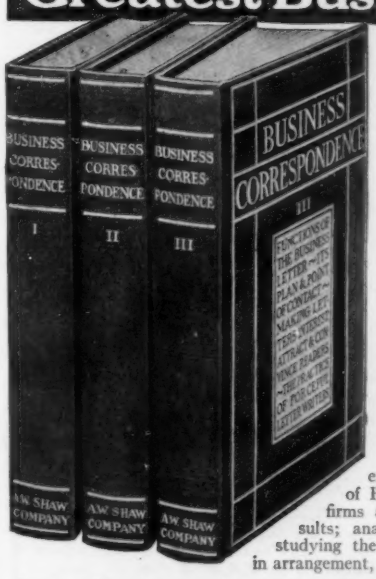

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